Flying Training

T-37 Life Support Equipment

July 2001

Air Education and Training Command

Designed for AETC Course Use

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AETC Student Guide P-V4A-A-JL-SG

July 2001

This student guide lists all the objectives for each unit of instruction in T-37 Life Support Equipment. These objectives identify what you need to learn. Develop an understanding of the material by answering the review questions at the end of each unit. These questions also provide an excellent review. The answers to these questions are in the back of this book. The next planned revision is July 2004.

OFFICIAL

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Summary of Changes

This revision has been changed to reflect the new HQ AETC/DOZ courseware format. Lessons JL0106, Descent and Landing Techniques, and JL0107, Parachute Familiarization Training, have been moved to this block of instruction from the Joint Aerospace Physiology block of instruction. Spelling and grammatical errors have been corrected throughout. Some graphics have been updated.

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Contents

IBT — Instructor-Based Training

Lesson JL0101 — 2.0 Hours

Oxygen Equipment

Goals

1. Identify the characteristics of the four types of oxygen storage systems.
2. Identify the characteristics of the three types of oxygen delivery systems.
3. Identify the operational and emergency ceilings of the pressure demand system.
4. Identify the functions of the narrow panel regulator.
5. Identify the components of the narrow panel regulator.
6. Identify the components of the MBU-12/P oxygen mask.
7. Identify the component parts of emergency oxygen systems.
8. Identify the procedures necessary to perform a PRICE check.
9. Identify the proper care of the mask and helmet.

Assignment

1. Read JL0101 in the SG and answer the review questions.
2. Read Oxygen System, Section I, T.O. 1T-37B-1, *Flight Manual.*

Introduction

We realized very early in flying that additional oxygen is required at altitude. Without protection from the effects of reduced barometric pressure, the human body is a limiting factor in aircraft performance. Therefore, aircraft oxygen systems have paralleled the progress of aircraft performance. These systems include various types of oxygen equipment.

The physiological requirement for oxygen at altitude is obvious. Air Force Instruction 11-202, Vol. 3, *General Flight Rules*, recognizes this physiological need by requiring all crewmembers to use supplemental oxygen when cabin altitude exceeds 10,000 feet mean sea level (MSL). Supplemental oxygen is either a mixture of aviator's breathing oxygen and ambient air or 100% aviator's breathing oxygen. Aviator's breathing oxygen may be stored as a gas, liquid, or solid. It must also be odorless, colorless, and tasteless (free from contaminants). The moisture content is minimal to prevent freezing and restriction of the aircraft oxygen system.

An aircraft oxygen system consists of containers to store the oxygen, delivery systems to control the pressure and percentage of oxygen, and a properly fitted mask (with helmet) to ensure application of the oxygen. The final component is you, the *educated user* — perhaps the most important and complicated component of the system.

Information

Before we discuss the individual components of oxygen systems, we need to identify a few precautions to ensure the integrity of the mask and helmet.

Facial medications and make-up (cosmetics) should not be used with supplemental oxygen and oxygen equipment. These materials include lipstick, face creams and powders, eye make-up, and false eyelashes. These substances may clog the inhalation and exhalation valve of the oxygen mask by rubbing off and building up on the valve.

Your hair should not be too long or too bulky. Helmet retention during inflight egress depends on proper helmet fit. Proper helmet fit depends on hair length and bulk. When helmets are worn, natural hair (loose and unbound) must not extend below the bottom of the collar. Buns, braids, hairpieces, and similar items preclude proper fit and are not permitted. Pins, ornaments, earrings, barrettes, and clips are prohibited to prevent the potential for foreign object damage (FOD). Long hair can fall over the eyes and interfere with vision, or become entangled in aircraft or life support equipment during normal and emergency operations. In many operational environments, you will perspire enough to wet the hair. Longer, bulkier hair reduces ventilation and inhibits evaporation (cooling). These restrictions apply to both hypobaric chamber and aircraft flights.

Oxygen Storage Systems

Goal 1 — Identify the characteristics of the four types of oxygen storage systems.

Oxygen is carried in cylinders or containers mounted in the aircraft. The location of these containers depends on the type of aircraft. They may be found in the wings, fuselage, or cabin. Air Force oxygen systems are classified by the method in which the oxygen is stored.

Low-pressure Gaseous System

This oxygen is stored in lightweight yellow cylinders. The system is considered full at 425 pounds per square inch (psi) ± 25 psi (400-450 psi). A low-pressure gaseous system reduces the possibility of explosions, requires very little maintenance, and limits the volume of oxygen. This limited volume dictates immediate descent to altitudes not requiring supplemental oxygen any time the pressure drops below 100 psi (operationally empty). When a system drops below 50 psi, it must be refilled within two hours to prevent contamination or water formation. If this requirement is not met, the system must be purged (cleaned) to rid the system of the contaminants and water vapor. AFTO Form 781 must be annotated anytime the system drops below 50 psi. The T-37 uses a low-pressure gaseous system as the primary source of oxygen. Section I of the T-37 Flight Manual contains the approximate duration of the T-37 oxygen system.

High-pressure Gaseous System

In this system, oxygen is stored under extremely high pressure in cylinders painted green for identification. The system is considered full when the pressure is 1,800 psi to 2,000 psi and operationally empty at 200 psi. The cylinders must be heavily constructed to contain the high pressure. Reinforced cylinders reduce the danger of explosion, but increase weight and reduce the performance capabilities of the aircraft. The T-1A uses high-pressure gaseous systems. The emergency oxygen cylinder found in the parachute pack is a modified example of this system.

Liquid Oxygen (LOX) System

The LOX system is one of the more advanced oxygen systems and is found in newer aircraft. Oxygen is stored in a liquid state and converted to gas by a converter. Since one unit of liquid oxygen yields about 860 units of gaseous oxygen, storing the oxygen in a liquid state saves about 70% in space and weight. Because of the extremely low temperature of LOX (a boiling point of -182.8 °C), handling and servicing the system are its only disadvantages. Low-pressure LOX systems, found on single- or dual-place aircraft, normally maintain a line pressure of approximately 70-90 psi. High-pressure LOX systems, found on multi-place aircraft, normally maintain a line pressure of approximately 300 psi. More importantly, the oxygen is measured in liters by a quantity gauge and is considered full at 95 %; empty at 10 %. The T-38 Talon uses a 10 liter, low-pressure LOX system as the primary source of oxygen.

Solid-State System

New processes can produce oxygen from a solid state. The sodium chlorate candle is such a system. It provides emergency oxygen to passengers in the C-5 Galaxy via a chemical reaction. The system is contained in a canister and is activated by removing a continuous flow mask from the canister. The user may detect a harmless amount of chlorine for about the first 12 seconds. The amount of oxygen supplied depends on the size and chemical reaction rate of the candle.

Protective Breathing Equipment (PBE), provided in the T-1A, is another example of a portable solid-state oxygen storage system.

On Board Oxygen Generation System (OBOGS)

The OBOGS concept of producing oxygen inflight provides the potential for increased operational safety and reduced logistical support of the system. The OBOGS filters oxygen from engine bleed air and stores it in a small container before delivery to the crewmember. The container is constantly being replenished with oxygen. Basically, as long as the aircraft has operating engines, oxygen is provided. The aircraft also contains an emergency gaseous system in case of OBOGS failure.

Oxygen Delivery Systems

Goal 2 — Identify the characteristics of the three types of oxygen delivery systems.

Goal 3 — Identify the operational and emergency ceilings of the pressure demand system.

Regardless of the basic configuration, all oxygen delivery systems serve the same purposes. Oxygen progresses from storage containers through distribution lines, regulated at a suitable flow rate or pressure, and is delivered to the mask. The oxygen regulator determines the type of delivery system you will be using. Three basic oxygen delivery systems are used in today's aircraft — continuous flow, diluter demand, and pressure demand. Each type can be provided in a fixed system (aircraft mounted) or a portable system (walk-around capability).

Continuous Flow System

The delivery method of a continuous flow system is just as the name implies — the regulator continuously delivers oxygen to you, whether you are inhaling or not. Obviously, this system wastes oxygen. To get oxygen, the crewmember opens a supply valve on the regulator. The more the valve is opened, the greater the flow of oxygen. A gauge on the regulator can be referenced so the oxygen flow can be adjusted with varying cabin pressure altitudes. The mask consists of a face piece and reservoir bag to direct the flow of oxygen to the nose and mouth. The operational ceiling for this system is FL250 and, in emergencies, it can be used to FL300. Some continuous flow systems are modified for use at higher altitudes and are normally installed in transport, medical evacuation, and commercial aircraft. The emergency oxygen cylinder in the parachute pack is another modified continuous flow system rated to provide emergency use up to FL500.

Diluter Demand System

This system is designed to mix the correct amount of cabin air with 100% oxygen from the storage cylinders. The system delivers the mixture upon demand (inhalation). Sealed evacuated bellows (aneroid) expand and contract with changes in atmospheric pressure to determine the dilution process. The aneroid operates between sea level and FL340 to open and close the oxygen air valves. A manually operated override (diluter lever) has been incorporated to allow selection of 100% oxygen below FL340. The air inlet valve is closed when the lever is set on 100% OXYGEN, delivering exclusively 100% oxygen. The operational ceiling of this system is FL350 and the emergency ceiling is FL400. Diluter demand regulators are used in the T-1A.

Pressure Demand System

High-performance aircraft frequently fly above FL400. At this altitude, 100% oxygen alone is insufficient to maintain normal levels of blood oxygen saturation. Positive pressure breathing is necessary to increase the lung pressure above the atmospheric pressure. This increase is mandatory for survival at altitudes above FL400. The pressure demand oxygen system has been developed to protect you from hypoxia at the higher altitudes. The regulators used in this system are different from the diluter demand system regulators, but function much the same until the positive pressure feature is activated. The pressure demand system has an operational ceiling of FL430 and an emergency ceiling of FL500 for very short durations.

Pressure Demand Regulators

Goal 4 — Identify the functions of the narrow panel regulator.

Goal 5 — Identify the components of the narrow panel regulator.

A-14A Manually Operated Regulator

The A-14A regulator functions much the same as a diluter demand regulator (described below) when the dial is on the NORMAL setting. This regulator delivers 100% oxygen at a pressure altitude of 34,000 feet and above. However, you must manually dial to the different altitude settings of the selector dial to increase the pressure. Turning the dial clockwise determines the amount of oxygen pressure delivered. You can also select 100% oxygen as necessary below 34,000 feet MSL. The oxygen system pressure gauge and flow indicator are separate from the regulator.

This regulator is used in some hypobaric chambers as a back-up system and to practice pressure-breathing techniques. You use this regulator prior to each aircraft flight, by operating the MQ-1 Tester, to ensure the integrity of your personal oxygen equipment.

Narrow Panel Automatic Regulator

Advances in aircraft design and performance demanded improvements in earlier models of regulators. An aneroid assembly was incorporated to react to atmospheric pressure changes and deliver oxygen under positive pressure. As the ambient altitude increases, trapped air in the aneroid gradually expands, automatically providing the correct proportion of ambient air to oxygen from sea level to FL320. At FL320, the aneroid closes completely and the regulator delivers 100% oxygen. Initial *safety pressure* is delivered between FL280 and FL320. A second stage of pressure is delivered at FL390.

Narrow panel regulators are the most widely used automatic pressure demand regulators in modern aircraft. The term narrow panel regulator refers to a series of regulators that are essentially the same in appearance and operation. As a result of the automatic features of these regulators, you are not distracted from flight duties to make the manual adjustments that were necessary with the earlier model pressure demand regulators. The regulators include types CRU-68/A, CRU-69/A and CRU-73/A. Differences in internal operating pressures, lighting, panel appearance, and safety features will be discussed by your instructor.

A detailed knowledge of the components and operation of these regulators is very important to you. The following section will provide the facts necessary to properly use the regulator. Reference Figure 1-1 as you study these components.

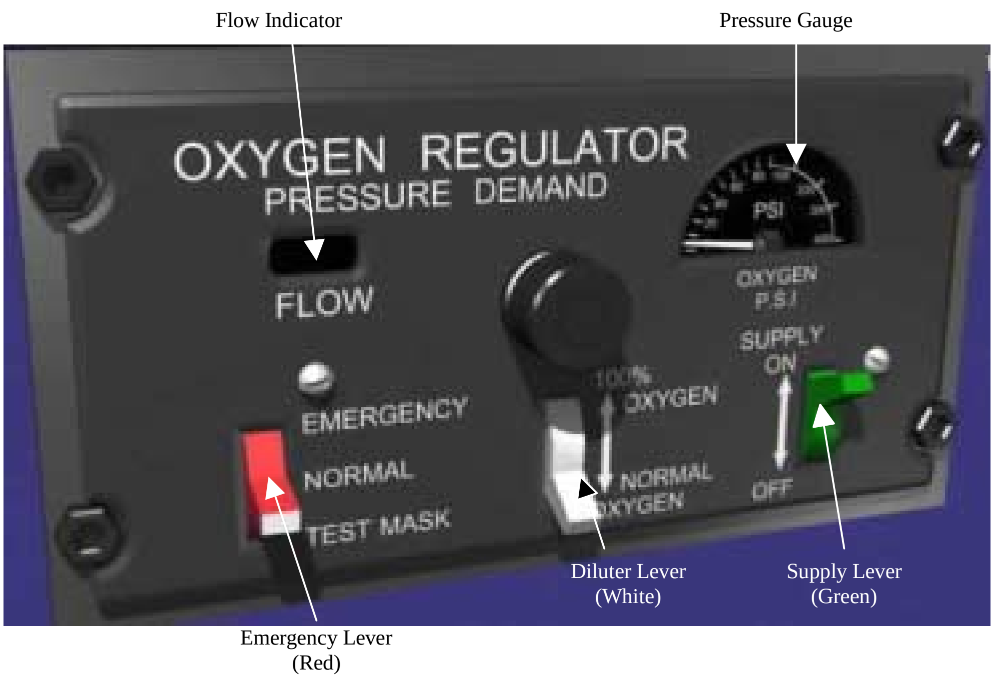

Figure 1-1 — Narrow Panel Regulator

Pressure gauge — is connected directly to the oxygen storage system and calibrated in psi pressure. You must know your aircraft oxygen storage system to determine the correct pressure reading of this gauge. This gauge should be monitored periodically during flight and any rapid or excessive drop in pressure should be considered cause for immediate descent.

Note — Low-pressure gaseous storage systems (T-37) will generally reflect a constant drop in pressure during ascent as a result of the atmospheric temperature decrease.

Oxygen supply lever — is the green lever on the right side of the regulator. In the up (ON) position, oxygen is permitted to enter the regulator from the storage supply. In the down (OFF) position, oxygen will not enter the regulator. Some narrow panel regulators do not contain an OFF WARNING feature, which means you can still breath ambient air through the regulator with the supply lever turned off and the diluter lever in the NORMAL OXYGEN position. AETC requires the supply lever to be safety wired to the ON position or protected by a switchguard in some situations.

Diluter Lever — is the white lever in the middle of the regulator. It's a two-position lever used for selecting normal or 100% oxygen. During most flight conditions, it is placed in the down (NORMAL OXYGEN) position to permit the regulator diluter mechanisms to function automatically. When cabin altitude increases, more 100% oxygen is added to the mixture until FL320 is reached. Then the ambient air port closes automatically and only 100% oxygen is delivered to you. The lever should be placed in the up (100% OXYGEN) position below FL320 for situations requiring 100% oxygen. When 100% oxygen is no longer required, the lever should be returned to the NORMAL OXYGEN position. When the regulator is not in use, place the diluter lever in the 100% OXYGEN position to close the ambient air port and prevent the introduction of contaminants.

Emergency lever — is the red lever on the left side of the regulator. This three-positioned lever permits you to select oxygen under various pressures. Normal flight conditions call for the emergency lever to remain in the middle (NORMAL) position. The up (EMERGENCY) position delivers oxygen under pressure. If the lever is in the spring loaded down (TEST MASK) position, the regulator delivers three to four times the pressure delivered by the EMERGENCY position.

Placing the supply lever ON, the diluter lever to 100% OXYGEN, and the emergency lever to EMERGENCY ensures you are receiving 100% oxygen under a slight safety pressure. This technique is referred to as *gangloading* the regulator. It's used to check the integrity of the mask and equipment, during suspected hypoxia/hyperventilation incidents or during smoke and fumes in the cockpit.

Flow indicator — is a small window in the upper left hand corner of the regulator. This indicator is a blinker-type instrument indicating white when a gas is flowing through the regulator. The window will be black when a flow is absent; as you inhale, the white indicator reappears. The indicator should be monitored frequently to ensure flow continues. It is important to remember that the indicator does not tell how much oxygen is flowing, only that there is a flow of gas.

Note — The regulators in the T-37 have prisms installed to present the flow indicator at eye level. This feature enables you to see the flow indicator without lowering your head.

Oxygen Mask And Helmet Assemblies

Goal 6 — Identify the components of the MBU-12/P oxygen mask.

Standard masks for diluter demand regulators do not work with pressure demand regulators. Advanced masks were designed to withstand the addition of positive pressure. The MBU-series pressure demand masks are specifically designed to be used with pressure demand oxygen systems and hold internal pressures in excess of ambient or outside pressure.

MBU-12/P Oxygen Mask

The basic functions of the newer MBU-12/P mask and the older MBU-5/P mask are the same. However, the new generation of fighter aircraft highlights the need for an oxygen mask that does not slide down the face in a sustained high-G environment, provides lower bulk and better visibility (lower profile), is constructed of a lighter material for less weight, and reduces the incidence of pressure points or hot spots during normal flights (comfort). The MBU-12/P mask illustrated in Figure 1-2 is available in four sizes — short, regular, long, and extra long.

Faceform/hardshell assembly — consists of a conforming silicone impregnated rubber faceform bonded to a plastic hardshell. The faceform should create a leak-tight seal around the mask-sealing flange throughout the range of pressure breathing. The silicone material eliminates facial reaction and tends to cling to the face. The plastic hardshell gives structural integrity to the mask, evenly distributes sealing forces to the oral-nasal regions, and acts as a platform for attaching adjustable bayonet straps. The lower part of the assembly houses the combination inhalation and exhalation valve. Minimum weight and maximum comfort were prime considerations in the overall mask design.

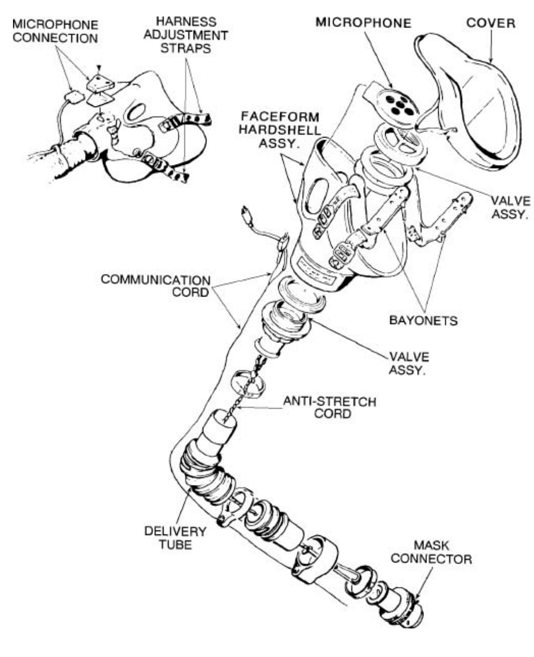

Figure 1-2 — MBU-12/P Oxygen Mask

Delivery tube (mask hose) — is made of corrugated silicone rubber, permitting freedom of movement without kinking the tube or restricting the oxygen flow. It attaches to the combination inhalation and exhalation valve stem at the base of the mask and to a mask connector at the other end.

Mask connector — is a three-prong connector securing the mask hose to the CRU-series connector assemblies. Rigid connection of the mask connector to the connector assembly prevents the mask hose from flailing in the event of emergency egress from the aircraft.

Anti-stretch cord — is a length of nylon cord located in the mask hose, attached to the combination inhalation and exhalation valve stem and the mask connector. Its sole purpose is to prevent the mask hose from over-stretching or disconnecting as a result of the windblast during a high-speed bailout. If the cord was not inside the mask hose, the hose could snap back and cause injury.

Microphone — is an integral part of the faceform, adapts to the aircraft communication system, and is easily adjusted to fit any individual.

Communication cord — is a limited stretch cord spiraling around the mask hose, mating with the microphone plug at the base of the mask nosepiece. Additional connections are mated with the headset plug below the left bayonet receiver and with the communication system plug. Upper and lower cable guides secure the communications cord to the oxygen mask hose.

Oxygen mask retention bayonets — are attached to the mask with adjustable straps anchored to the hard shell by screws. Inserting the bayonets into receivers on the flight helmet secures the mask to your face. Proper mask fit and comfort is maintained through individual adjustment.

Combination inhalation/exhalation valve — (Figure 1-3) is located in the floor of the mask. It consists of a circular flap that opens during inhalation and closes during exhalation, and a floating valve that is activated on exhalation. A pressure of only 1mm Hg greater than the pressure of the regulator supplied oxygen will force the valve open and allow exhaled air to pass to the outside.

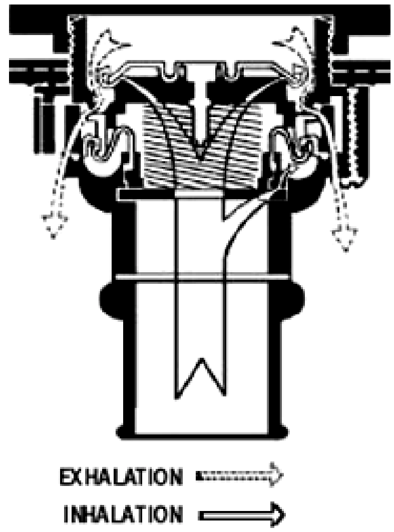

Figure 1-3 — Inhalation/ Exhalation Valve

MBU-5/P Oxygen Mask

The MBU-5/P pressure demand oxygen mask has separate faceform and hardshell assemblies. The harness adjustment straps are attached to the hardshell by two snap fasteners secured by screws. The combination inhalation and exhalation valve has a longer stem and the mask hose is also slightly longer. The mask connector, anti-stretch cord, microphone, and communication cord are basically the same as those in the MBU-12/P mask.

Note — The MBU-5/P mask is generally issued when you are unable to secure an airtight seal with the MBU-12/P mask. As a final alternative, a custom mask (designed similar to the 5/P) can be constructed for individuals who are unable to secure a seal with either the 5/P or the 12/P masks. A custom mask requires a referral from the flight surgeon's office.

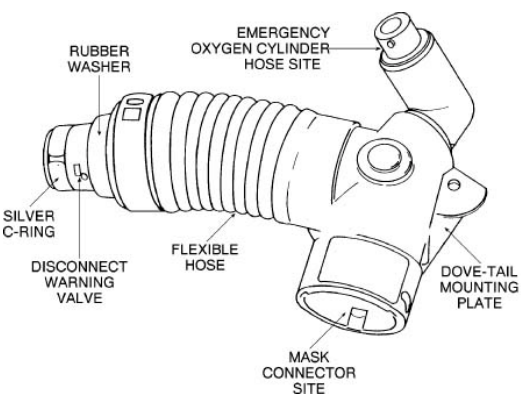

Figure 1-4 — CRU-60/P

MBU-10/P Oxygen Mask

The MBU-10/P oxygen mask, also known as the quick-don oxygen mask assembly, is available for crewmembers on the flight deck of several multi-place aircraft (KC-135, C-5, C-141, etc.). These assemblies incorporate a mask and quick-donning bracket (frame) and are suspended above each crew position. The masks are very similar to the MBU-5/P and MBU-12/P and are connected to either a diluter demand or pressure demand regulator.

Connector Assembly, CRU-60/P

The CRU-60/P is an oxygen mask-to-regulator connector assembly (Figure 1-4). It's essentially a three-way connector providing connection sites for the regulator hose, the mask connector, and the emergency oxygen cylinder hose. The CRU-60/P attaches to the parachute harness, at the intersection of the horizontal chest strap, by securing a dovetail mounting plate into a receiving bracket on the harness.

Regulator hose site — is on the end of the two-inch flexible hose and is a simple *push-pull* connection. A silver C-ring provides 12 to 20 pounds of disconnect tension. This tension is enough to maintain the connection during normal flight operations but permits automatic disconnect during ejection or ground egress. The two-inch flexible hose permits a 180-degree swing in any direction and contains an anti-stretch cord to prevent over-stretching during disconnect. The connection site also incorporates a rubber gasket to ensure an airtight seal and a disconnect warning valve to offer resistance of flow during inhalation if the inlet is not properly inserted into the aircraft oxygen regulator hose. This resistance is intended to warn the crewmember of accidental disconnection from the aircraft oxygen system. The valve also relieves excess pressure from the continuous flow emergency oxygen cylinder assembly.

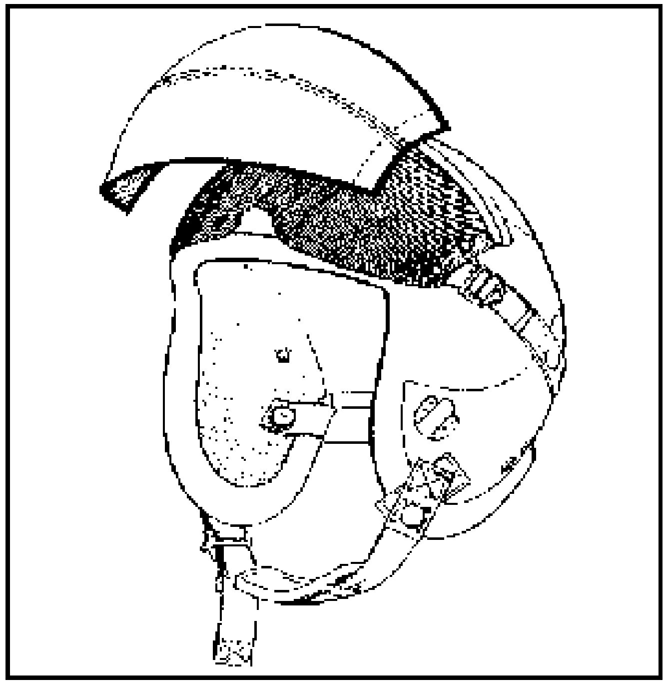

Figure 1-5 — HGU-55/P Helmet

Mask connector site — is the hard portion of the connector assembly and contains a black O-ring in a recess to ensure another airtight seal. The oxygen mask hose connects to this site with a *push-turn* action. If you were to leave your parachute behind during an emergency ground egress, you would disconnect the mask from the CRU-60/P at this site. Otherwise, always disconnect from the regulator hose site.

Emergency oxygen cylinder hose site — is the swivel attachment located on the side of the connector assembly, 180 degrees from the mask connector site, allowing simplicity of connection. The cylinder hose is a two-prong *push-turn* connection onto this site.

Protective Helmets

Undergraduate flying training uses the HGU-55/P helmet. The helmet was designed for use in high-performance aircraft. The 55/P helmet shown in Figure 1-5 is gray, constructed of lightweight material, presents a low profile, and has a detachable visor assembly. The function of the 55/P helmet is to provide protection from head injury, provide mounting for the visor assemblies, hold the oxygen mask in place, contain the headset for the communication system, and seal off external sounds that cause irritation and fatigue. The 55/P helmet is available in three sizes — medium, large, and extra large.

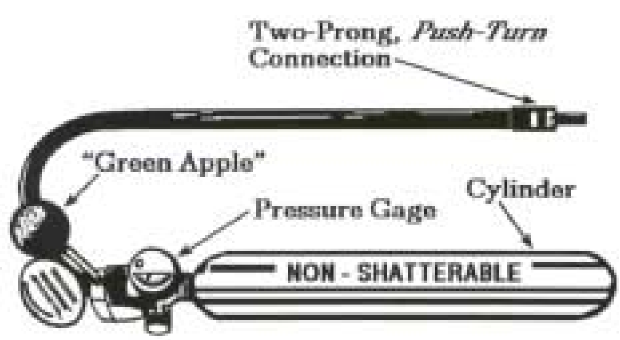

Figure 1-6 — Emergency Oxygen Cylinder

Emergency Oxygen Systems

Goal 7 — Identify the component parts of emergency oxygen systems.

Emergency Oxygen Cylinder

The emergency oxygen cylinder (Figure 1-6) is a high-pressure gaseous, continuous flow oxygen system. It will provide 100% oxygen anytime an alternate source of oxygen is needed. This requirement could be caused by failure of the aircraft oxygen system, the depletion of other supplemental oxygen sources, suspected aircraft oxygen system contamination or depletion, and or egress at altitudes up to FL500. The unit is normally installed in the parachute and is designed to provide a 10-minute supply of 100% oxygen under steadily decreasing pressure. Pulling the green ball-cable assembly (*green apple*) manually activates the unit. Once the oxygen flow begins, it cannot be stopped. This cylinder can also be found in personal oxygen kits used by passengers on military multi-place aircraft. The pressure range is 1,800 psi to 2,200 psi.

Portable Oxygen Assembly

The portable oxygen assembly is a low-pressure gaseous, manually operated, pressure demand oxygen system often referred to as a *yellow walk-around bottle* (Figure 1-7). The system provides 100% oxygen under varying degrees of pressure. The duration of the oxygen supplied depends on altitude, breathing rate, and physical exertion. The system is used as an emergency/alternate source of oxygen in the altitude chamber and in military multi-place aircraft.

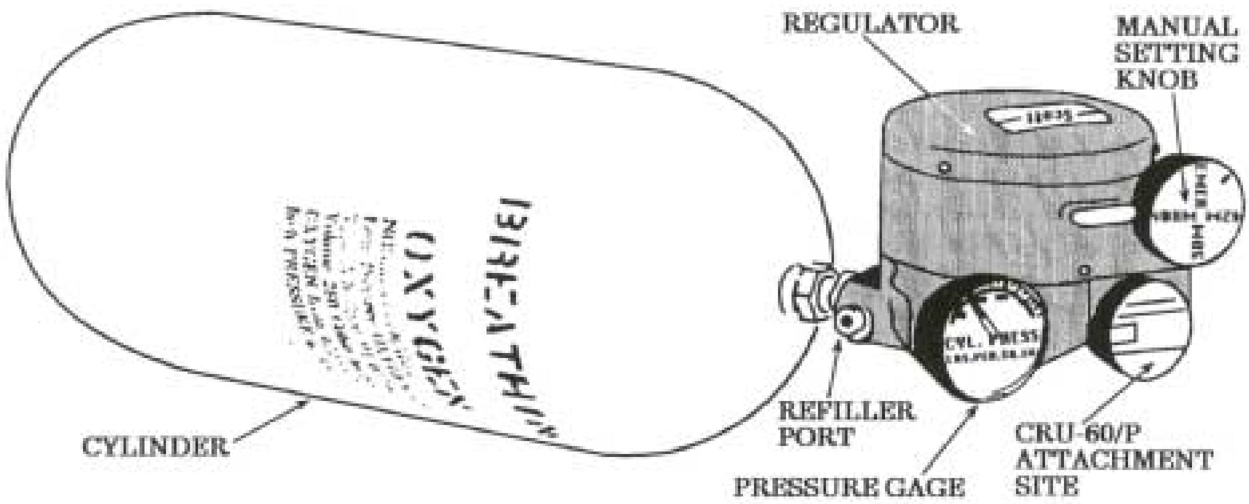

Figure 1-7 — Yellow Walk-Around Bottle

Preflight Checks

Goal 8 — Identify the procedures necessary to perform a PRICE check.

A preflight check of your personal oxygen equipment and the aircraft oxygen system will always be accomplished. Before going to the aircraft, you are required to inspect your personal oxygen equipment and test it with the MQ-1 Tester in the life support section. This brief inspection ensures the proper operation of the mask and helmet, independent of the aircraft system. As part of the interior check of the aircraft, you are required to check the integrity of your personal equipment with the aircraft oxygen system. This type inspection would seem to require hours to perform. But that is not the case; since a very simple method has been devised that affords you an easy but thorough basic check. It is organized so that each part is correlated with a key letter. When placed in order, the letters form the word *PRICE*. The following paragraphs will explain, in detail, the MQ-1 Tester and the PRICE check.

MQ-1 Tester

The MQ-1 Tester enables you to evaluate the operational capability of your helmet, mask, and communications prior to proceeding to the aircraft. The tester console consists of an A-14A oxygen regulator, an oxygen flow indicator, a standard communications cord, a two-position communications test switch, and a green communications test light. The tester console is normally positioned below a mirror, enabling you to visibly evaluate proper mask positioning and helmet condition (visor operation and general appearance) while performing the mask and communications checks. The tester console can be modified to accommodate equipment for simultaneous testing of more than one individual, but normally contains only one position.

When preparing for flying, use the following MQ-1 Tester procedural checklist:

1. Don the helmet.
2. Connect the CRU-60/P connector to the A-14A oxygen regulator hose.
3. Connect the communications cord.
4. Don the mask, inserting the bayonets to the second click of the receivers or until the end of the bayonets are flush with the exit of the receivers.
5. Visually check the mask position in the mirror.
6. Perform a complete PRICE check (using the A-14A regulator on the 41M setting).
7. Place the communications test switch to the "ON" position (after verification of proper mask inhalation and exhalation function).
8. Observe the illumination of the green test light and aurally monitor breathing. Speaking will further verify proper communications function.

Note **—** If any aspect of the oxygen or communications checks is faulty, return the helmet and mask to life support personnel for corrective action. Then, repeat the checklist procedures.

9. Turn off the communications test switch if proper functions have been verified.
10. Turn off the A-14A regulator.
11. Disconnect the right mask bayonet and oxygen/communication leads.

PRICE Check

The PRICE check is not restricted to just the initial interior inspection of the aircraft. It is a preflight, inflight, and postflight inspection of your oxygen equipment and system. Also perform this inspection whenever a malfunction of the oxygen equipment or system occurs or is suspected.

P — Pressure. The oxygen pressure gauge should indicate a pressure of

1. 425 $\pm$ 25 psi (400-450 psi) for low-pressure gaseous oxygen systems.
2. 1,800-2,000 psi for high-pressure gaseous oxygen systems.
3. 50-120 psi for low-pressure LOX systems.

R — Regulator.

1. Check the general external condition and appearance of the regulator. Visually inspect the regulator for dents, cracks, broken pressure gauge or flow indicator lenses, and legibility of printing. There should not be any oil, grease, water, etc. on the regulator. Inspect for proper movement of levers (dials/switches).
2. Check the internal condition and function (integrity) of the regulator with the mask on and connected to the aircraft regulator hose. Use the following steps to conduct the internal check:
    a. Supply lever — "ON"
    b. Diluter lever — "100% OXYGEN"
    c. Emergency lever — "EMERGENCY"
    d. Breathe normally for a minimum of three cycles; the flow indicator should show alternate black and white.
    e. Hold your breath. If the flow indicator remains black, system integrity is confirmed. If the indicator is white while holding your breath and the emergency lever in the "EMERGENCY" position, either the system or mask is malfunctioning.

f. Diluter lever to “NORMAL OXYGEN.” The flow indicator should remain black. A white indicator warns of a leak

Note — It’s possible for the flow indicator to give a false indication of a leak with excessive head movement. To receive an accurate indication, hold your head still and look straight into the flow indicator.

g. If a leak is suspected, locate the cause, correct and repeat steps a through f.

Warning *— If any leaks are detected, corrective action must be taken prior to flight.*

I — Indicator. With the Diluter lever in the “100% OXYGEN” position, check the flow indicator for proper operation. Once proper operation is verified, return the Diluter lever to the “NORMAL OXYGEN” position. The indicator can also be used to monitor your rate and depth of breathing if you suspect hypoxia or hyperventilation.

C — Connections. Check the regulator hose for wear, tear, or deterioration. Check the regulator hose site of the connector assembly for the presence of the silver C-ring and rubber washer. A 12 to 20 pound pull should be required to separate the regulator hose from the connector assembly. Reconfirm proper connections of the oxygen mask hose and the regulator hose. Check the three communications cord connection sites.

E — Emergency. Ensure the emergency oxygen cylinder hose is properly connected to the connector assembly and in good condition. A check of the pressure gauge for a minimum pressure of 1,800 psi must be completed during the parachute preflight inspection, since the pressure gauge is not accessible when the parachute is worn.

Care of the Mask and Helmet

Goal 9 — Identify the proper care of the mask and helmet.

Dos

1. Have the life support section inspect the mask at least every 30 days.

2. Inspect and test the mask for operation before leaving the life support section (MQ-1 Tester).

3. Clean and test the mask at the end of each flying day. Use cleaning solution and gauze pad to wipe interior of the mask faceform to remove perspiration, facial oils, and foreign matter (required by AETCI 11-301).

4. Check the helmet prior to each flight for overall condition. Check security of chin and nape straps, visor lens for cracks and scratches, cleanliness and operation of lens, attachment of communication connectors, and operation of communication connectors.

5. Check the mask and helmet daily for wear and tear. Have items replaced as necessary.

6. Check the bayonet connectors and ensure that the locking pins operate freely.

7. Whenever possible, transport the helmet assembly in a helmet bag. When unable to carry the assembly in a helmet bag, carry the helmet and mask by the chin strap like a bucket.

8. Have the life support section inspect your helmet any time it is dropped or cracked.

Don’ts

1. Don’t paint the helmet. Mark only as directed by applicable technical orders.

2. Don’t carry the helmet by the intercom cord or mask.

3. Don’t allow the helmet to strike objects that would damage the protective surface.

4. Don’t disassemble the mask. This requires special tools and should be done only by qualified life support personnel.

5. Don’t modify or alter the mask.

6. Don’t store the helmet/mask in direct sunlight or hot environments for lengthy periods of time, or in the aircraft when off station.

7. Don’t allow sharp objects to come in contact with the mask because any puncture could damage the mask.

8. Don’t use pencils, pens, or sharp objects to loosen troublesome or sticking valves.

9. Don’t loan equipment. It was fitted and intended for personal use only.

Remember! — This is your personal life support equipment. Treat it as a personal possession and it will give you many years of trouble-free service. If at any time you have questions or problems concerning equipment, contact life support personnel for assistance.

As you know, complacency is a lack of concern for actual dangers or deficiencies. The oxygen equipment we employ today is extremely reliable and checking it each time we fly may seem as overcautious as checking for gravity each day. However, a fact of human nature demonstrates the more reliable equipment is, the less concern we show for that equipment. As a result, we place a tremendous amount of faith in our equipment and when it finally fails, we often refuse to believe it. Conducting an interpersonal argument with yourself about your equipment is not desirable while experiencing the final stages of hypoxia. Oxygen equipment can fail and its condition must be checked prior to each flight. You must not become overconfident in your equipment. Be aware actual equipment malfunctions still occur. Considering these facts and using your oxygen equipment will help you become an *educated user*, well aware of the usefulness of your equipment and its limitations.

Oxygen Equipment Lab

At the conclusion of the classroom presentation or prior to the denitrogenation time of your Type 2A Hypobaric Chamber Flight, you will receive an oxygen equipment lab. The lab will:

1. familiarize you with the hypobaric chamber and its equipment.
2. ensure the proper operation and function of your life support oxygen equipment.
3. reinforce the objectives of the oxygen equipment classroom presentation and alleviate apprehensions associated with hypobaric chamber operations.

Summary

The use of oxygen equipment is one of the mechanisms used to counteract the effects of decreasing barometric pressure. Supplemental oxygen on board aircraft can be stored as a high- or low-pressure gas, a liquid, a solid; or an On-Board Oxygen Generating System can generate it. The oxygen is then delivered via a continuous flow, diluter demand, or pressure demand system through an oxygen mask to the user. The T-37 uses a narrow panel regulator as part of a pressure demand system to deliver oxygen stored in the low-pressure gaseous form. In addition to the primary oxygen system, there are several types of emergency oxygen systems. The high-pressure emergency oxygen cylinder found in the parachute is the emergency source of oxygen for the T-37 pilot. Even with all the equipment available, the key link is the user. Proper knowledge of how your oxygen equipment works and how to effectively perform a PRICE check will ensure your equipment is properly functioning throughout normal flight operations and emergency conditions.

Review Exercise JL0101

Complete the following review exercise by choosing the correct answer(s) or filling in the blanks.

1. Determine if the following characteristics refer to (A) high-pressure or (B) low-pressure gaseous oxygen storage systems.

    a. _____ Full pressure — 1,800-2,000 psi

    b. _____ Full pressure — 400-450 psi

    c. _____ Color coded green

    d. _____ Color coded yellow

    e. _____ Empty pressure — 100 psi

    f. _____ Empty pressure — 200 psi

2. Study the narrow panel automatic pressure demand regulator in Figure 1-8. Place the correct number beside the following components:

    a. _____ Pressure gauge

    b. _____ Oxygen supply lever

    c. _____ Diluter level

    d. _____ Emergency lever

    e. _____ Flow indicator

Figure 1-8 — Narrow Panel Regulator

3. Indicate if the following statements are True or False describing the purpose, function, and or operation of the narrow panel automatic pressure demand regulator.

   a. _____ Automatically provides the correct proportions of ambient air and oxygen from sea level to FL320.

   b. _____ Has an emergency altitude of FL400.

   c. _____ Can be used with only a low-pressure gaseous oxygen storage system.

   d. _____ Has an operational altitude of FL430.

   e. _____ Has an emergency altitude of FL500.

   f. _____ Requires close monitoring by the crewmember to ensure proper operation.

   g. _____ Will begin to deliver initial safety pressure between FL280 and FL320.

   h. _____ A white indication of the flow indicator indicates a proper quantity of oxygen is being delivered.

4. Study the MBU-12/P oxygen mask in Figure 1-9. Place the correct number beside the following components:

   a. _____ Faceform/hardshell assembly

   b. _____ Delivery tube (mask hose)

   c. _____ Mask connector

   d. _____ Anti-stretch cord

   e. _____ Microphone

   f. _____ Communication cord

   g. _____ Oxygen mask retention bayonets

   h. _____ Combination inhalation/exhalation valve

   i. _____ Harness adjustment straps

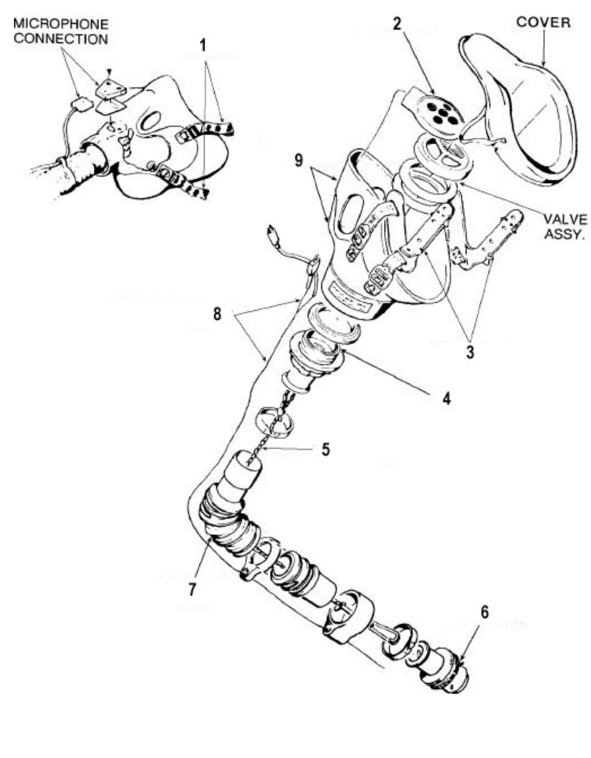

Figure 1-9 — MBU 12/P Mask

5. Place a letter of the PRICE check next to the appropriate statement:

   a. _____ The regulator pressure gauge indicates 425 psi.

   b. _____ Check the emergency oxygen assembly for pressure of 1,800 psi and connection.

   c. _____ Check for neoprene O-ring (rubber washer).

   d. _____ Diluter lever to 100% OXYGEN and check the flow indicator.

   e. _____ Check supply lever — ON.

   f. _____ Check proper connection of the mask hose to the CRU-60/P.

   g. _____ Check regulator hose for wear, tear, or deterioration.

   h. _____ If the flow indicator is white while holding your breath with the emergency lever in the EMERGENCY setting, either the mask or the system is leaking.

6. List five Dos and five Don'ts for proper care of the oxygen mask and protective helmet assemblies.

Dos

   a.

   b.

   c.

   d.

   e.

Don'ts

   a.

   b.

   c.

   d.

   e.

7. Select the four statements describing the purpose, duration, and or operation of a high-pressure gaseous emergency oxygen cylinder.

   a. _____ It has a duration of approximately 3 to 5 minutes.

   b. _____ Normally provides a 10-minute supply of 100% oxygen.

   c. _____ It has a duration of approximately 12 to 15 minutes.

   d. _____ The oxygen flow can be shut off at will.

   e. _____ The oxygen flow cannot be stopped once it has been activated.

   f. _____ It delivers 100% oxygen on demand.

   g. _____ It delivers 100% oxygen on a continuous basis.

   h. _____ It is activated automatically on ejections above 14,000 feet.

   i. _____ It may be activated in the event of oxygen system failure.

   j. _____ It may only be activated prior to ejection.

Lesson JL0102 — 1.5 Hours

The Parachute

Goals

1. Identify the functions of parachute components.
2. Identify the steps of the descent checklist and the order they should occur.
3. Identify the correct procedures for the following parachute landings:
   a. Ground
   b. Water
   c. Trees
   d. Power lines
   e. Night (ground/water)

Assignment

Read JL0102 in the SG and answer the review questions.

Introduction

The chief factor influencing an ejection or bailout decision is fear of the unknown and is the biggest problem for a crewmember to overcome. During an inflight emergency, it's not uncommon to feel safer staying with the aircraft than ejecting or bailing out. Being in the aircraft may make you *feel* safer, but that safe feeling is there only because the aircraft is substantial and familiar. If the aircraft is in trouble, a delay of even a few *seconds* may mean loss of life.

Too often, ejection or bailout fatalities are the result of hesitation and indecision. Ignorance or fear of parachuting can produce these delays. Even those who parachute for a living display a certain degree of fear. Having a little fear and controlling it is not only natural, but also desirable since it tends to keep you more alert and helps you remember procedures. Don't shy away from a decision to use the parachute. It's issued for the sole purpose of giving you a safe recovery when the aircraft cannot.

Handle the parachute carefully. Many parachutes have been accidentally deployed because the parachute arming knob or ripcord handle caught on something. Don't place the parachute on the floor or ramp where it may become dirty or damaged. Fuel, oil, or grease will weaken the fabric. A wet parachute can also cause problems with parachute deployment. If any defects are noted, return the parachute to life support personnel immediately and get a replacement.

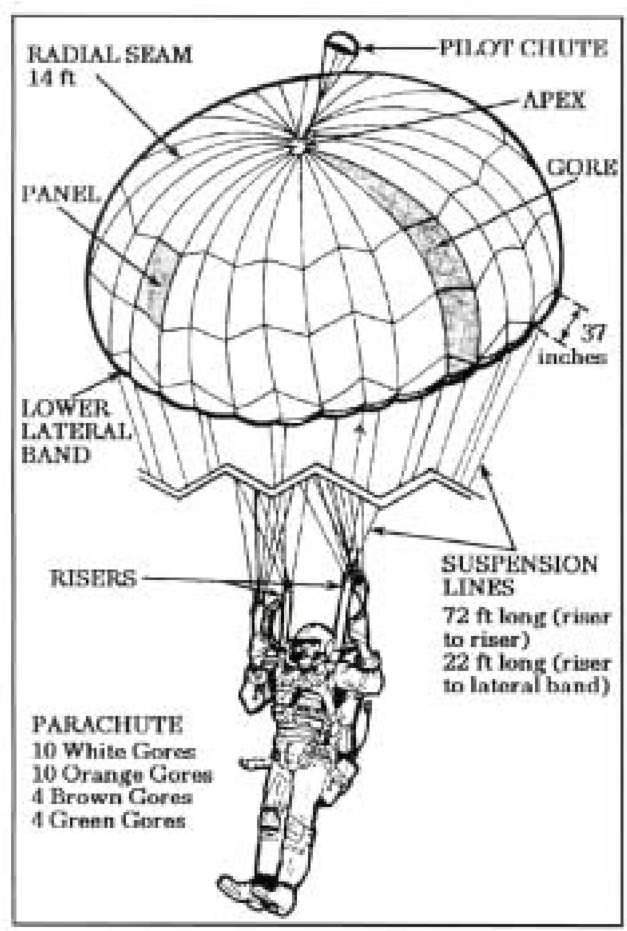

Figure 2-1 — Parachute Diagram

Information

Components and Devices

Goal 1 — Identify the functions of parachute components.

Reference Figures 2-1 and 2-2 for parachute components and devices.

Parachute Components

The parachute is a vehicle demanding skill and knowledge by the individual using it. The three main components of a parachute assembly are the harness, the canopy, and the pack.

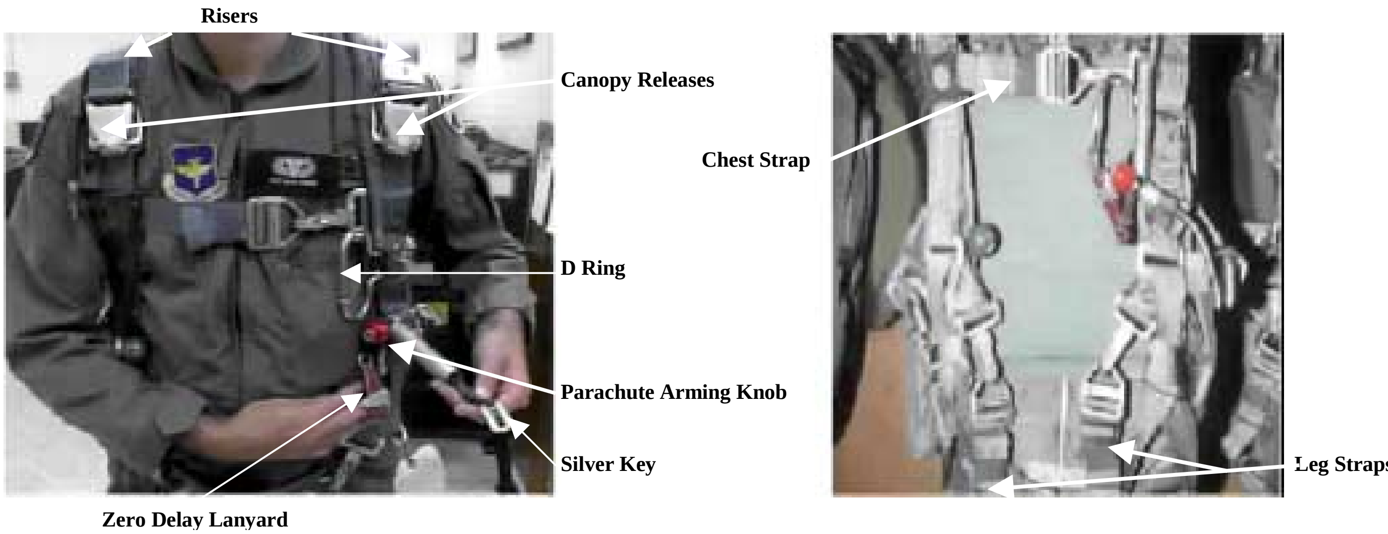

Figure 2-2 — Back Parachute

The parachute harness — consists of nylon webbing designed to secure the parachute to the crewmember. Harnesses start as a loop of webbing called a sling. Both ends of the sling are attached to the parachute suspension lines similar to a swing attached to a tree; the sling absorbs most of the opening shock. To prevent falling out of the sling, there are adjustable leg straps, diagonal back straps, a horizontal back strap, and a chest strap. When you fit and adjust the parachute harness during your preflight, you will usually adjust only the two leg straps and the single chest strap.

The C-9 canopy — used in personnel parachutes is constructed of rip stop, mildew-proof nylon and is 28 feet in diameter with 14 suspension lines. Nylon is stronger and produces less opening shock than silk. One square yard of parachute nylon weighs only 1.1 ounces, but will support 1,500 pounds in direct tension. The suspension lines used with the C-9 canopy have a tensile strength of 550 pounds. Each suspension line starts at a harness riser connector link, goes to the canopy skirt, over the canopy apex to the opposite skirt, and back down to the harness. The lines are continuous, without splices or knots. They pass through the center of the canopy gore seams (section of panels running from the lower lateral band or skirt to the apex of the canopy) and are sewn at the skirt and the apex of the canopy. A spring-loaded pilot chute is attached to the apex of the canopy by nylon webbing called a bridle line. During deployment, the pilot chute traps air and pulls the canopy from the parachute pack. A quarter deployment bag, within the parachute pack, contains the lower one-fourth of the canopy. This bag has pockets and flutes for folding and storage of the suspension lines to reduce/eliminate entanglement during deployment.

The parachute pack — is a mildew-proof nylon container protecting and storing the canopy, suspension lines, and any accessory devices. The pack is held closed by ripcord pins that are extracted by the automatic actuator or by pulling the ripcord handle. Enclosed within the parachute pack are emergency items such as the SRU-16/P minimum survival kit, the emergency oxygen cylinder, a personal locator beacon, and the automatic ripcord release/timer. A signal mirror, signaling kit (flares), and knife are attached externally to the parachute pack.

Back Parachute Devices

There are primarily three types of personnel parachutes in the USAF inventory — the self-contained, the attachable chest, and the back. You will use a back parachute during UFT and this text will limit information to this type.

The back parachute is preferred for general use because of flexibility and improved comfort. It hugs the body resulting in a smaller overall silhouette. Egress through broken aircraft canopies and emergency hatches are easier with this parachute. The harness is easily adjusted and allows use of survival accessories. The personal parachute used in the T-37 incorporates a C-9 canopy, an automatic ripcord release/timer, and zero-delay lanyard among other devices.

Canopy releases — facilitate jettisoning the canopy and prevent high winds from dragging you on land or in water. The modified J-1 releases of your parachute are two motion releases and use a “pop-out” cable loop actuated latch arm. Pulling out and down unsnaps the safety cover. Unsnapping the safety covers frees the cable loop stowed under the cover and acts as its own spring to “pop” in a prominent position for the next release motion. A sharp tug or jerk on the cable loop with the thumbs opens the canopy releases.

Ripcord handle (D-Ring) — is attached to a stainless steel cable with two ripcord insertion pins on the end retaining the pilot chute and keeping the pack closed. When the handle is pulled, the pins are removed and the pack is unlocked. A ripcord handle should be jerked as far as your arms will allow taking up the slack in the cable. The handle should not be pulled gently. Pulling the ripcord handle will bypass all automatic features of the parachute.

Parachute arming knob — By pulling the arming knob, an aneroid activated lock blocks the timing mechanism until free fall to the preset altitude of 14,000 feet. Ejecting below 14,000 feet activates the timing device immediately because the aneroid lock no longer stops its operation. When the one-second timer runs out, a ballistic device is actuated and reels in the power cable, pulling the ripcord insertion pins. Pulling the insertion pins releases the pilot chute, the main chute, and the quarter deployment bag; this sequence in turn, allows the suspension lines to fully extend before the canopy becomes fully inflated.

Zero delay lanyard (T-37) — is directly connected from the arming lanyard anchor to the ripcord handle and bypasses the automatic feature of the parachute. The zero-delay lanyard must be connected to provide immediate deployment of the parachute during low altitude egress.

Parachute arming lanyard anchor (silver key) — The automatic feature on the actuator of the ripcord release/timer occurs on seat separation or by manually pulling the arming lanyard knob. Seat separation will automatically activate this actuator only if the arming lanyard anchor is installed on the safety lap belt swivel link, an action that must be accomplished when strapping into the aircraft seat.

Automatic ripcord release/timer — will automatically deploy the parachute and is located behind the left shoulder (in the pack) when the parachute is worn. Parachute rigger personnel set this device to effect deployment at an established altitude and time interval. The deployment altitude is 14,000 $\pm$ 1,000 feet MSL and the time interval is 0.75/1.0 second for the T-37 parachute. A pin mounted in one end of the timer prevents premature parachute deployment.

Figure 2-3 illustrates the mechanical linkages involved in automatic and manual deployment of the parachute.

Preflight Inspection of Pack and Harness

Although the probability of ejection or bailout is minimal, your parachute should be treated as though you expect to use it each flight. If it’s necessary to use the parachute, it must work perfectly. Life support personnel inspect the parachute every 30 days and parachute shop personnel repack it every 180 days. A record of these inspections is maintained on AFTO Form 391, carried in the parachute. You must ensure the parachute remains in excellent condition while in your possession, even ensuring that the necessary inspections are performed. It will function properly only if you handle and use it correctly.

The parachute is considered an emergency recovery system. All crewmembers must be completely familiar with the required preflight check. Prior to the first flight of the day, proceed as follows:

Chest and leg straps **—** Check snaps and keepers.

Ripcord — Stowed.

Automatic actuation knob — Stowed.

Zero delay lanyard — As required.

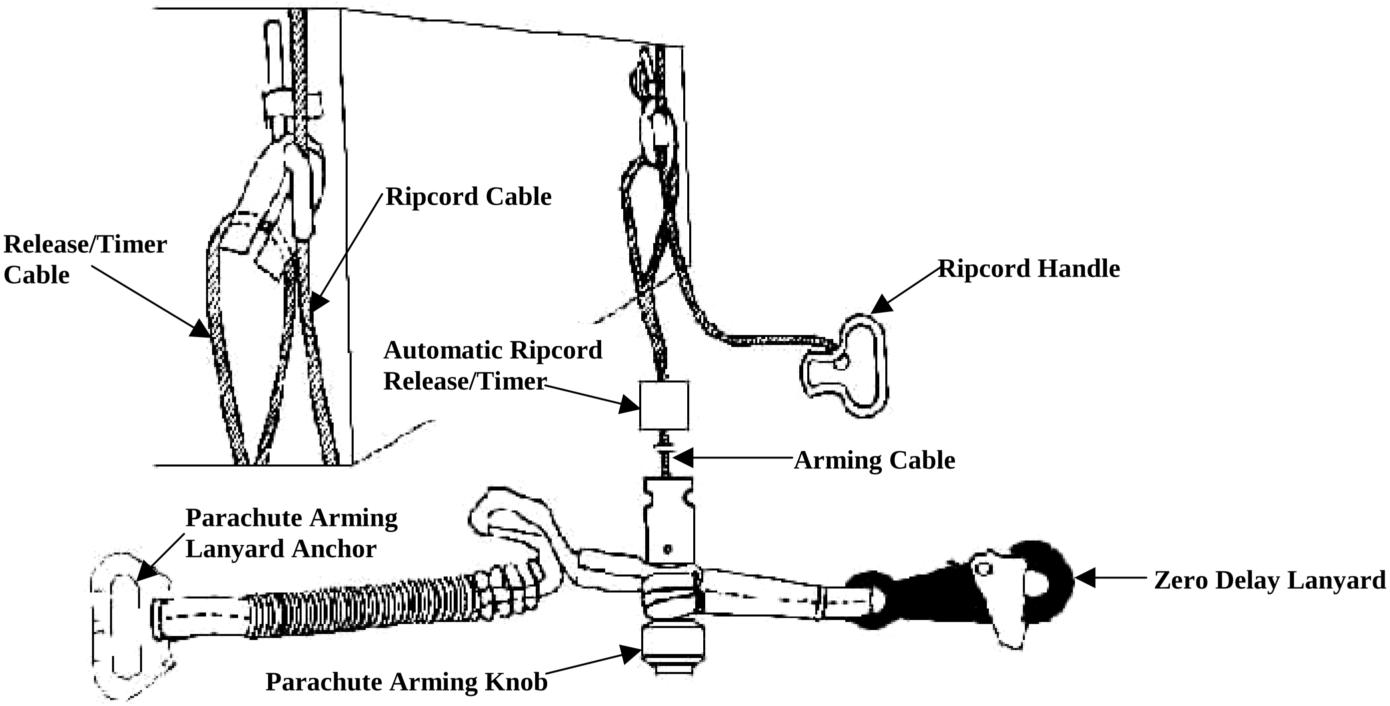

Figure 2-3 — Parachute Activation Devices

Canopy releases — Closed (do not open safety covers)

Emergency oxygen — Check pressure.

Back pad — Secure.

Automatic ripcord release — Type SCOT

-Visually check for white tape on lower nut threads.

-Physically check to ensure lower knurled nut is finger tight.

-Physically check barrel to ensure it is finger tight.

-Physically check upper knurled nut to ensure it is finger tight.

Note — Contact a life support technician if you find any discrepancies with the release.

Zippers — Closed.

Dual housing clamp — Check for damage and to ensure power cable housing is attached and screws are secure.

Risers — Straight and tacked to pack.

Pack — Closed with no canopy showing.

Stains — Check for oil, acid, water, etc.

The above checklist is abbreviated and can be expanded if additional life support equipment is added to the assembly. If there is any doubt as to serviceability or parachute condition, request assistance from life support technicians.

Proper fit of a parachute harness depends on your knowledge of how a harness should look and feel when worn, as well as how it adjusts. With the harness donned and the chest strap attached, the canopy releases should be level with each other and positioned just below the collarbone. The seat sling should cross slightly above, midway across the buttocks. If the harness is properly fitted and adjusted while standing, the straps should press firmly against the body making it difficult to stand at "attention." Proper fit and adjustment is extremely important during opening shock. The harness will loosen to a comfortable position when you are seated.

Phases of Parachuting

Goal 2 — Identify the steps of the descent checklist and the order they should occur.

Goal 3 — Identify the correct procedures for the following parachute landings:

a. Ground

b. Water

c. Trees

d. Power lines

e. Night (ground/water)

The two phases of parachuting are the bailout and descent/landing phases. The following paragraphs are a discussion of the procedures that should be followed during each.

Bailout Phase

The guidelines for ejection or bailout can differ with each aircraft type. For more detailed information, read the aircraft flight manual describing the appropriate escape system. When using an ejection seat, keep the following three things in mind. First, the recommended minimum controlled ejection altitude is 2,000 feet above the terrain while in level flight conditions. Much higher terrain clearance is necessary when the aircraft is uncontrollable. Lower altitude ejections may be possible under emergency conditions depending on the aircraft type, ejection system, aircraft attitude, and airspeed. Second, the parachute requires a certain amount of airflow for inflation. At low altitude, airspeed becomes more critical for a successful parachute deployment while at high altitude, airspeed becomes less important since time (altitude) for parachute deployment is greater. Third, immediately after egress, separate from the seat. Seat separation will ensure no delay in parachute arming or deployment. An automatic device, the seat-man separator, has been installed on the ejection seat to facilitate separation. Seat-man separation is achieved when the lap belt releases and a take-up reel assists in separating the crewmember from the seat.

Descent/Landing Phase

During the descent phase the crewmember has now separated from the ejection seat and is in a free fall or opening shock has occurred and the crewmember is under an open canopy and gliding toward the ground. If in a free fall the crewmember should assume the *military free fall body position* and immediately after opening shock, the descent checklist should be completed. If parachute deployment has already taken place, assess time and conditions and either begin the descent checklist or begin landing preparation.

Military free fall body position — This body position should be assumed immediately after checking the ripcord handle or arming knob. It is the rapid and potentially violent deployment of the pilot chute and canopy that can cause injuries. A parachute deploying between the legs can result in a painful injury. Therefore, prepare for the parachute opening by placing (1) chin on chest; (2) legs together; and (3) arms across chest (left forearm over the right forearm; do not grasp the D-ring with the right hand; place the left hand near the emergency oxygen cylinder “green apple”).

Although most inflight egress occurs below 15,000 feet MSL, it may be necessary to eject above this altitude. The military free fall body position should prevent spinning or tumbling problems. However, during an extended high altitude free fall — even using the military free fall position — you could reach terminal velocity (the maximum rate of descent for a free-falling object) and experience severe body spinning or tumbling. A flat body spin usually starts as your body approaches terminal velocity and is especially noted where your body has assumed a back down, head low attitude in relation to the ground. The spin may be in either direction, and onset of the spin may be gradual or rapid. A flat body spin, if sufficiently severe, can be dangerous and result in loss of consciousness or serious injury. Severe tumbling may occur at any time during the free fall. Severe tumbling is where your body tumbles head over heels in a rapid motion, causing confusion and a dangerous body position for parachute deployment.

If your body is in a spin, or you are experiencing severe tumbling, move your arms and legs to a wide *spread eagle* position as follows: (1) arch your back and throw your head back; (2) extend your arms horizontally, with the elbows slightly bent. Turn your palms down and cup your hands slightly; and (3) spread your legs about 45 degrees and bend your knees in a relaxed position. These movements will break or slow the spin or tumble. Once the tumbling or spinning has been stopped, remain in the spread eagle position. If you believe the automatic ripcord release/timer has failed and are below 14,000 feet MSL, grasp the ripcord (or arming knob) with the right hand and pull using the left hand to guide and assist.

***Warning** — Do not attempt to pull the ripcord above 14,000 feet MSL to stop a flat spin or tumbling. Pulling the ripcord above this altitude may result in hypoxia, frostbite, excessive parachute opening forces, parachute entanglement and or parachute damage.*

Parachute deployment sequence — Changes in parachute design, method of packing, and other innovations have reduced the intensity of opening shock. The C-9 canopy deploys when the ripcord pins are manually or automatically released from the locking loops. The spring-loaded pilot chute releases, fills with air, and pulls three quarters of the canopy from the pack. The remainder of the canopy releases after the suspension lines are pulled from the quarter deployment bag.

After the suspension lines deploy, the locking loop in the quarter deployment bag releases and the remaining portion of the canopy pulls from the bag allowing air to enter the channel of the main canopy. The quarter deployment bag falls away and the canopy inflates to its maximum capacity. Each step in the opening process is designed to provide gradual deceleration, not an immediate opening shock. The sequence of events is depicted in Figure 2-4.

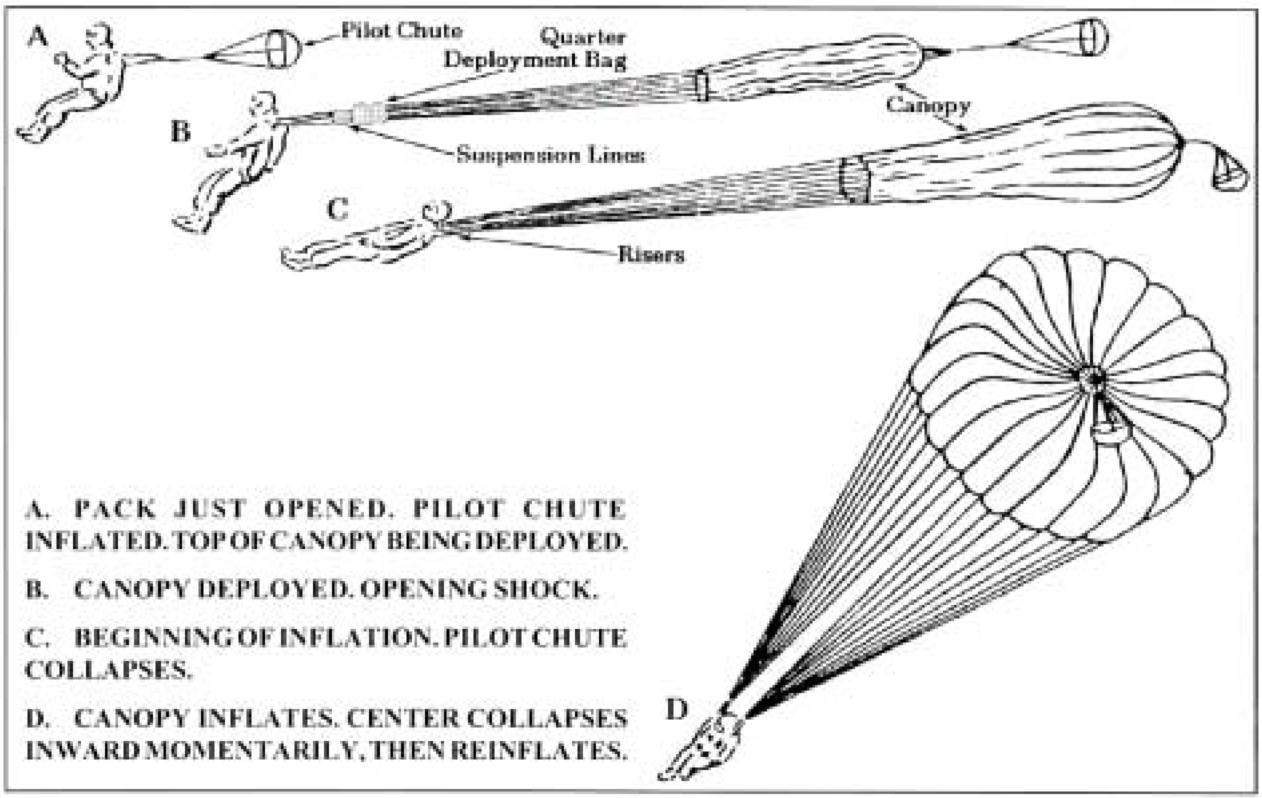

Figure 2-4 — Canopy Deployment and Inflation

Note — As the canopy inflates and the risers become taut, the personal locator beacon is activated and transmits an emergency signal.

Parachute opening shock — Deceleration or opening shock is influenced by several factors depending on parachute deployment — whether it occurs immediately after ejection/bailout or after a period of free fall.

1. Air density. The less dense the air, the less friction available to help slow you down after a high-speed ejection/bailout. Air density also influences terminal velocity. If a crewmember egresses from an aircraft traveling slower than terminal velocity for a specific altitude, the descent rate will increase during free fall until terminal velocity is attained. Should egress occur from an aircraft traveling faster than terminal velocity, the crewmember will decelerate to the terminal velocity for that altitude. If free fall does not occur (low altitude, high speed, uncontrolled — immediate deployment of the parachute is necessary), travel will be at nearly the same velocity as the aircraft at the time of parachute deployment. Complete deceleration will then occur during parachute deployment. Whether free-falling at terminal velocity or whether deploying the parachute at speeds faster than terminal velocity, excessive G forces will

occur. Ideally, except for very low altitude (below 2,000 feet above ground level (AGL)), the pilot should attempt to reduce aircraft speed prior to egress, especially at higher altitudes when terminal velocity provides insufficient deceleration for safe parachute deployment.

Figure 2-5 illustrates that a free fall terminal velocity of approximately 200 mph at FL400 produces a force of about 30 Gs for parachute opening shock. Free-falling to an altitude of 14,000 feet MSL, where terminal velocity is approximately 132 mph, produces a more tolerable 9 G force during parachute opening shock. This reduction in G force is a good rationale for deploying a parachute at lower altitudes and slower velocities.

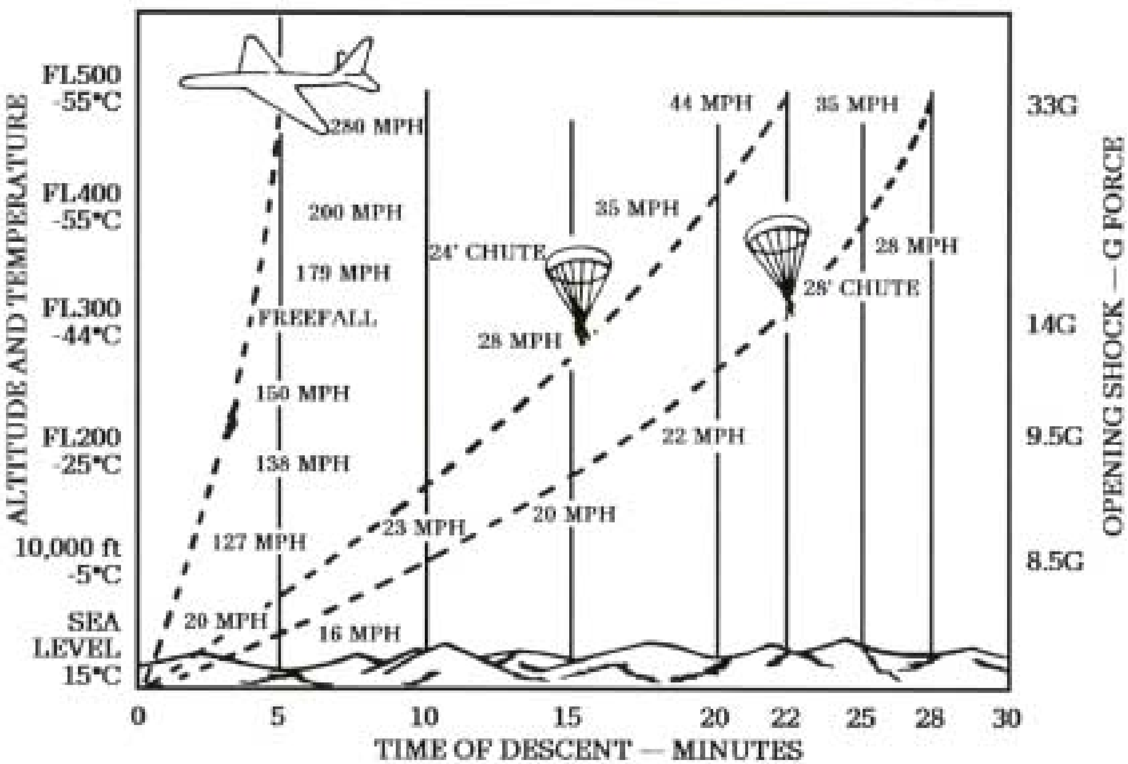

Figure 2-5 — Terminal Velocity and Time of Descent

Deploying the parachute immediately after exiting the aircraft at higher altitudes exposes you to increased velocities, resulting in reduced inflation time and increases deceleration and G force.

2. Canopy size. Increased canopy size results in reduced shock. However, the distance required for inflation is greater. A parachute must transition through a distance about eight times its diameter before it is exposed to enough air volume adequate for inflation. The primary disadvantages of a very large canopy are increased weight and size of the pack. The current 28 feet diameter canopy is the optimum size for reduced opening shock and inflation time.

3. Type of material. A strong, lightweight, pliable, and porous canopy material is extremely important to the crewmember. Nylon is currently used because it doesn't mildew and it stretches during deployment to absorb some opening shock.

4. Rate of deployment. The size of the pilot chute, the length of the suspension lines, and the method of packing control parachute deployment. The drag produced by deployment of the canopy and suspension lines results in a slower deceleration of the crewmember and effective reduction of opening shock.

Descent checklist — After opening shock, the following descent checklist should be completed.

***Note* —** The following steps are provided as a guide and may be accomplished in a different sequence depending on the circumstances surrounding a particular ejection. The crewmember must exercise judgment in determining which steps are most critical to enhance his chances of survival, i.e., ejection/bailout at low altitude over land — check canopy and deploy survival kit (if applicable); or ejection/bailout in total darkness — immediately assume the parachute landing fall (PLF) position and disregard all other steps.

CANOPY — Check

VISOR — (as appropriate)

MASK — Discard

SURVIVAL KIT — Deploy (if applicable)

LPUs — Activate (if applicable)

FOUR LINE JETTISON LANYARDS — Pull

LANDING — Prepare (as appropriate)

The following paragraphs specifically address the techniques and procedures you should accomplish while completing the checklist.

CANOPY — Check. The canopy check is the first step in the descent checklist and should be accomplished immediately after opening shock. You are checking the canopy to determine if there are any malfunctions that you can clear prior to landing. Malfunctions can increase oscillations and the rate of descent. If you are near the ground, no attempt should be made to correct the malfunction. But, if the malfunction is detected at higher altitude, corrective measures should be attempted. Several possible parachute malfunctions may occur.

1. Full inversion. The canopy can open inside out (the pilot chute will be visible in the center of the canopy). If it's a front to rear inversion, the red loops for the four-line release will be located on the front risers. If the canopy inverted side to side, the risers will be crossed above your head. In either case, the canopy will function normally. Procedures for performing the four-line release remain unchanged. However, the steering will differ depending on the location of the red lanyards.

2. Partial inversion. This malfunction occurs when part of the parachute has passed under the skirt of another part and has opened inside out. If your parachute forms a figure eight instead of a circle, you have a partial inversion. This malfunction normally results in minor canopy damage, a slightly higher descent rate, and can increase oscillations. Take the following corrective actions if altitude permits:

    a. Locate the lines and riser group coming from the smaller lobe.

    b. Grasp this riser group and slowly continue to pull the riser until you can grasp the lines attached to the smaller lobe (excluding any lines that may happen to go over the canopy). Pull the lines down and then quickly release them. There may be some concern as to how far you can pull down on the suspension lines. A good rule to remember is: do not pull the lines down far enough to have loose suspension lines below your knees; if pulled too far down, the lines may entangle with your feet or legs when they are released.

3. Line over. This malfunction occurs when a portion of the canopy passes under one or more lines and then inflates. Like the partial inversion, the canopy will form two lobes. But unlike the partial inversion, there will be an obvious channel connecting the two lobes. The canopy may sustain minor damage in the form of burns and small holes. Your rate of descent and oscillations will increase. A line over can be corrected using the same procedures described for partial inversions. Several attempts may be necessary for either malfunction. As a last resort, use the hook blade knife to cut the line(s) causing either malfunction.

***Warning* —** *Do not cut riser webbing or more than four suspension lines. All four cut lines may be adjacent to each other. However, do not perform the four-line jettison modification if any line(s) have been cut.*

***Note* —** These malfunctions are not cleared while pulling the lines. The malfunctions clear when the lines are <u>quickly</u> released. While a partial inversion will attempt to slide off the canopy using this procedure, it may be necessary to repeat the procedure several times to clear the malfunction.

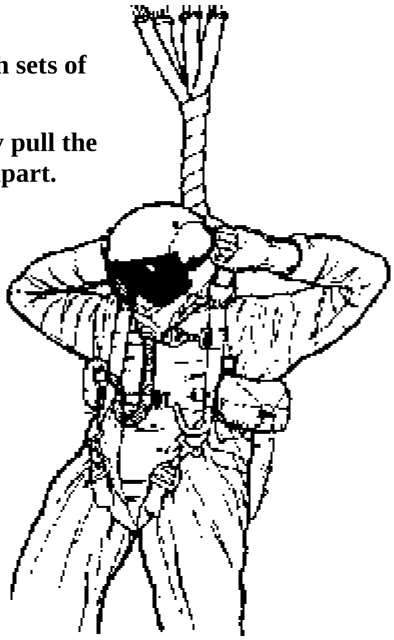

Figure 2-6 — Twisted Risers

4. Blown panels and broken suspension lines. Blown panels or holes in the canopy and broken lines may increase the rate of descent and reduce canopy control. Obviously, these malfunctions cannot be corrected. However, proper execution of the PLF will help remedy the situation.

5. Twisted risers and suspension lines. The parachute risers and suspension lines may often twist during opening. This problem may cause your head to be forced down to your chest and you may not be able to check your canopy. Riser twists are caused by poor body position during canopy deployment. Reach up and spread the risers with your hands to untwist the risers and lines. Another technique that some parachutists use to speed untwisting is bicycling their legs while spreading the risers. Figure 2-6 illustrates a twisted risers malfunction.

6. Streamers. Streamers occur when the risers, suspension lines, and canopy are twisted — a total malfunction of canopy inflation. Your only recourse is to gather the suspension lines and canopy into your body and throw them down and away from the direction of your spin or tumble. Repeat the process until the canopy inflates.

VISOR — (as appropriate). The next step in the descent checklist is to raise or lower your helmet visor. The visor should be lowered for a tree landing and for all other landings it should be raised.

OXYGEN MASK — Discard. After raising the visor, discard the oxygen mask. Failure to discard the mask could result in injury during landing procedures. To discard the mask, you release bayonet connections to the helmet, disconnect the communications cord and remove the CRU-60/P connector and throw the mask away.

Note — Difficulty may be encountered in depressing the positive “Red Dot” release on the communications cord when discarding the oxygen mask assembly. A quick jerk (approximately 10 pounds) on the oxygen mask communications cord may be used to disconnect it from the helmet. Helmet chin strap must be snug.

SURVIVAL KIT — Deploy. A survival kit will weigh several pounds and be attached to your buttocks. Landing with it attached will cause a poor landing body position and increase injury potential. Deploying prevents landing injuries because you will be able to better prepare for landing and it reduces added weight.

LPUs — Activate (if applicable). If flying with LPUs and you are landing in water, activate the LPUs by pulling sharply downward and slightly outward on the lanyards extending from the lower front corner of each container. If a failure occurs, the life preserver can be orally inflated prior to entry into the water, thereby reducing possible confusion after water entry. Connect the inflated cells with the Velcro® straps provided.

Note — LPUs will be worn for certain phases of flight in AETC aircraft.

Two types of LPUs are available and crewmembers should be familiar with each. The basic types are LPU-2/P and LPU-10/P (Figure 2-7). To don these preservers, insert your arms through the shoulder straps. Ensure the containers are under each arm and that the actuating lanyards are positioned in the lower front corners. Ensure that the straps are properly positioned, adjusted, and not twisted. Adjust the shoulder straps so the containers are as high under the armpits as can be comfortably tolerated. Next, don the parachute so that the containers are positioned outside

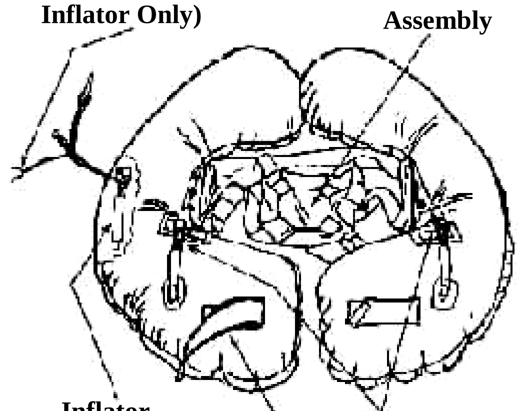

Figure 2-7 — Life Preserver Assembly

the parachute harness. Adjustment of the parachute harness should guarantee a proper fit for egress as well as adequate LPU inflation for water entry.

FOUR LINE JETTISON LANYARD — Pull. The next step is to gain canopy control. Pulling the four-line jettison lanyards does this. During descent you will probably encounter oscillation, a pendulum-like swing caused by the uneven spilling of air from under the canopy or induced by a difference in wind direction and speed at various altitudes. All USAF parachutes have been rigged with a four-line jettison lanyard modification designed to dampen oscillation and provide the capability to turn the parachute canopy. To activate the modification, locate the jettisoning lanyards installed on each rear riser strap. The lanyards are identified by a red loop appearing on the inside surface of each rear riser at about arm's length. Glance up and to the rear over each shoulder and locate the red loop. If the hand tacking through the risers has not broken during the parachute opening, grasp either riser above the tacking and tug sharply to break the tacking and free the loop. Grasp the red pull loops and give a sharp tug (both sides) to release the four lines. Air will spill from the rear of the canopy. Additional sharp tugs may be required to ensure all four lines are released.

1. Grasping the appropriate red lanyard loop and pulling it down enables turning. Continue to pull on the applicable loop until the desired amount of turn has been made. Then, slowly release the loop. Along with stabilization and steer ability, the modification reduces the descent rate by providing 3 to 5 knots of forward velocity (in calm wind conditions).

Warning — *The modification should not be attempted when (1) there is a malfunction such as a partial inversion or broken suspension lines; or (2) it is dark, unless a definite determination can be made that canopy and suspension lines have not been damaged during the ejection and parachute opening sequence.*

***Note* —** The four-line jettisoning system may be used at any altitude, but it is recommended that it be completed prior to 200 feet above the terrain.

2. Remember the modification is designed to improve the steer ability and stabilization of the parachute and improving these will reduce the potential for injury.

3. Reaching high on the appropriate rear riser (i.e., right turn — right rear riser; left turn — left rear riser) and pulling it down into the chest enables quicker turns. Slowly release the riser when the desired rate of turn is accomplished.

4. Canopy control is also possible by using the risers to slip (lateral movement) the canopy. Grasp the appropriate set of risers, (i.e., right slip — right front and right rear riser; left slip — left front and left rear riser) and pull down. Continue to pull on the riser set until the desired amount of turn or slip has been made. Slowly release the risers.

5. Turns and slips should be made at high altitudes in conjunction with prevailing winds to make observations and to glide towards a safe landing area. Use the same turning or slipping action at lower altitudes to clear hazardous ground obstacles and to face the wind for landing.

Obviously, check for a probable landing area with the least number of obstacles and steer toward this area. Complete all attempts at correcting malfunctions, performing modifications, and turns or slips 200 feet above the terrain, regardless of the landing area. At 200 feet, you should now begin preparation for landing. You do this by making a final turn into the wind and preparing for the appropriate parachute landing.

LANDING — Prepare. The final step of the descent checklist prepares you for the most common landing situations you may encounter. They are landing on the ground, in the water, in power lines, in trees, or at night.

Ground landing preparation — In preparing for a ground landing, the first thing to remember is to always give yourself enough time to turn the canopy so you are facing into the wind for landing. Turn into the wind when you are approximately 200 feet above the terrain so you are not in an awkward landing attitude. Turning into the wind permits the inherent canopy glide to counteract the prevailing wind to some degree and reduces the chances of a landing injury. After turning into the wind, place your right hand over the right release and your left hand over the left release. This position puts the elbows in the best position for a PLF.

Warning — *Do not open the canopy release covers during parachute descent. To do so would increase the possibility of inadvertent actuation of the canopy releases.*

1. The PLF should be prepared for and performed as follows:

   a. Keep your eyes on the horizon. Do not look straight down at the ground, as it will interfere with your ability to judge distance.

   b. Place your feet together. Bend your knees slightly and point your toes toward the ground. Do not force the position of your legs or feet as tenseness can lead to injury.

   c. Relax — repeat — relax.

   d. Take the initial shock of landing on the balls of the feet with your knees slightly bent.

   e. The next point of impact should be on the side of one leg. A slight body twist in either direction at the instant your feet touch the ground will help.

   f. The next points of contact should be the thigh, hip and back of the shoulder in that order.

   g. Activate canopy releases.

Warning — *Do not activate canopy releases prior to ground contact due to the difficulty of accurately determining height above the terrain.*

2. Parachute drag recovery procedures after ground landing. In the event you are being dragged face down, accomplish the following procedures:

   a. Do not panic.

   b. Reach high on the risers and grasp both riser sets.

   c. Push down on one riser set and lift up on the other set, at the same time twisting onto your back.

   d. Spread your legs.

   e. Head up.

   f. Slide your hands down the risers until they come in contact with the canopy releases.

   g. Activate both releases.

   h. If you are being dragged on your back, procedures “d” through “g” apply.

Water landing preparation — For preparation of a water landing, the first thing to remember is to always give yourself enough time to turn the canopy so you are facing into the wind for landing. Turn into the wind when you are approximately 200 feet above the water so you are not in an awkward landing attitude. Turning into the wind permits the inherent canopy glide to counteract the prevailing wind to some degree and reduces the chances of canopy/suspension line entanglement and being dragged face down in the water. If flying with LPUs, they should have been activated as part of the descent checklist. Ensure this is completed prior to 200 feet above the water. Now that you are facing into the wind, prepare for a PLF just as you would for a ground landing. After the landing, activate canopy release on water contact.

1. Parachute drag recovery after water landing. In the event you do not effect a canopy release on water contact and are being dragged face down, accomplish the following procedures:

   a. Do not panic.

   b. Hold your head up, face out of the water.

   c. Spread your legs.

   d. Activate your canopy releases.

2. If you are being dragged on your back, the following procedures apply:

   a. Spread your legs.

   b. Sit up.

c. Place chin on chest.

d. Activate your canopy releases.

3. Entanglement. After a water landing, it's possible for a crewmember to become entangled in the parachute canopy and or suspension lines. Follow these procedures if this situation occurs.

a. Do not kick your feet or thrash around. Keep calm. Remember, you can breathe under the canopy.

b. Keep your feet and legs together at all times.

c. Locate any main seam (the seams with suspension lines in them) and follow it to the edge of the canopy. Follow the main seam hand-over-hand, from back to front over your head, until the canopy skirt is reached.

***Warning** — Pulling the canopy main seam front to back will result in further entanglement.*

d. If suspension line entanglement is still a problem, after you reach the canopy skirt, attempt to clear the lines by hand.

e. If necessary, clear entanglement with the hook blade knife located on the right front riser.

f. Discard the canopy.

g. When you are clear of the canopy, paddle steadily away from the canopy.

Power line landing preparation — Use the four-line jettison or the rear risers to help steer away from obstacles. Landing in telephone or power lines may be inevitable. If possible, accomplish the following procedures prior to landing in the power lines. The first thing to remember is to always give yourself enough time to turn the canopy so you are facing into the wind for landing. Turn into the wind when you reach approximately 200 feet from the power lines so you are not in an awkward landing attitude. Turning into the wind permits the inherent canopy glide to counteract the prevailing wind to some degree and reduces the chances of power line landing injury.

***Warning** — Jettison survival kit (if time permits) prior to entering the power lines to preclude possible hang-up.*

1. After turning into the wind accomplish the following procedures.

a. Put your hands over your head with palms flat against the inside of the front risers.

b. Turn your head to the side and place your chin on your left or right shoulder.

c. Keep your feet and knees together and toes pointed to avoid straddling a line.

2. Just like any other landing, always be prepared to perform a PLF because you may go through the power lines.

Tree landing preparation — The first thing to remember is to always give yourself enough time to turn the canopy so you are facing into the wind for landing. Turn into the wind when you reach approximately 200 feet from the trees so you are not in an awkward landing attitude. Turning into the wind permits the inherent canopy glide to counteract the prevailing wind to some degree and reduces the chances of tree landing injury.

***Warning** — Failure to discard the oxygen mask could result in injury during landing procedures.*

1. The completion of the following procedures will ensure that you are in the proper configuration for a tree landing (Figure 2-8). Accomplish these procedures after passing through 200 feet AGL and prior to landing in the trees.

a. Visor down.

b. Feet and legs together. Do not cross legs.

c. Elbows and forearms together in front of chest. Simultaneously, tuck your chin in, place your thumbs along the lower edge of the jawbone, use your palms to protect your cheeks

Figure 2-8 — Tree Landing

and cover your nose and mouth with closed fingers. Extend your fingertips on the outer surface of the lowered helmet visor. This configuration will deflect twigs and branches from the throat, mouth and nose area. Ensure that the underside of your chin and throat are protected.

Warning *— Do not open canopy release safety covers.*

d. Do not try to stop or slow your descent through the tree(s) by grabbing limbs. Be ready for a PLF if you do not hang up.

e. Do not be in a hurry to get down if your canopy hangs up. Rest a moment and evaluate your position.

2. As with any other landing, always be prepared for a PLF in case you penetrate the trees and hit the ground.

Night landing preparation — If you can determine your landing environment, use the applicable procedures outlined in ground landing procedures, water landing procedures, and tree landing procedures. If you cannot determine your landing environment, use the following procedures:

1. Prepare for landing immediately after parachute opening.
2. Be prepared for terrain contact at any time, but do not try to anticipate landing. Also be prepared for PLF.
3. Check canopy, if possible.
4. Visor up
5. Discard mask

Warning — *Failure to discard the oxygen mask could result in injury during landing procedures.*

Warning *— Do not perform a four-line jettison modification unless a definite determination of canopy/suspension line damage can be made.*

At night, the four-line jettison is accomplished only to reduce oscillations. However, if your drift can be determined, turn the canopy so that you are facing into wind.

The remainder of the procedures will depend on whether or not you land on ground or water. If you have landed in the water, accomplish procedures outlined in parachute drag recovery after water landing. If you have landed on the ground, procedures for PLF and or parachute drag recovery after ground landing apply.

Summary

The parachute provides an effective means of emergency escape from a disabled aircraft. The T-37 uses a back style parachute consisting of harness, pack, and C-9 canopy components. Knowledge of the proper function and inspection procedures for all the parts of the parachute are important in ensuring proper function should you ever need to eject. The parachute is capable of automatic or manual deployment at the appropriate altitude following seat-man separation and free fall when necessary. After opening shock, the descent checklist should be performed to check the condition of the canopy, correct any malfunctions, and prepare for landing. Normal landing on the ground requires the performance of a PLF. In the event of a pilot being dragged along the ground or through the water during high winds, drag recovery procedures must be employed. While steering to avoid obstacles and therefore accomplishing a normal landing is desired, it is not always possible. Correct steps should be taken in the event a pilot encounters trees or power lines prior to landing. The pilot should still be prepared for a PLF and drag recovery should they pass through the trees or power lines.

Review Exercise JL0102

Complete the following review exercise by choosing the correct answer(s) or filling in the blanks.

1. Match the parachute device with its purpose.

Device

a. _____ Ripcord handle

b. _____ Automatic ripcord release/timer

c. _____ Parachute arming knob

d. _____ Parachute arming lanyard anchor (silver key)

e. _____ Zero delay lanyard

Purpose

1. If connected, it provides immediate deployment of the parachute during low altitude egress.
2. When pulled, it bypasses all automatic features of the parachute.
3. Automatically deploys the parachute at an established altitude and time interval.
4. Arms or activates the automatic ripcord release/timer; depending on altitude.
5. Installed on the safety lap belt swivel link allowing automatic activation of the actuator.

2. Number the following *tree landing* procedures in the order they should occur during parachute descent.

a. _____ **VISOR —** Down.

b. _____ **FOUR LINE JETTISON LANYARDS** — PULL.

c. _____ **CANOPY** — Check.

d. _____ **SURVIVAL KIT** — Deploy.

e. _____ **LANDING** — Prepare.

f. _____ **MASK** — Discard.

3. Number the following *water landing* procedures in the order they should occur during parachute descent.

a. _____ **VISOR —** Up.

b. _____ **FOUR LINE JETTISON LANYARDS** — Pull.

c. _____ **CANOPY —** Check.

d. _____ **SURVIVAL KIT** — Deploy.

e. _____ **LANDING** — Prepare.

f. _____ **MASK** — Discard.

g. _____ **LPUs —** Activate.

4. Number the following *ground landing* procedures in the order they should occur during parachute descent.
    a. _____ **CANOPY** — Check.
    b. _____ **FOUR LINE JETTISON LANYARDS —** Pull.
    c. _____ **VISOR** — Up.
    d. _____ **SURVIVAL KIT —** Deploy.
    e. _____ **LANDING** — Prepare.
    f. _____ **MASK** — Discard.

5. Select the incorrect statement concerning the four-line jettison (red lanyards) modification.
    a. Decreases parachute descent rate.
    b. Provides forward speed.
    c. Reduces parachute oscillation.
    d. Should be activated immediately upon contact with the ground.
    e. Improves parachute control.

6. Describe the correct preparation for and the performance of a PLF.

Lesson JL0103 — 3.0 Hours

T-37 Egress

Goals

1. Identify the purpose and function of specific components of the T-37 canopy system.
2. Identify the purpose of T-37 ejection seat components.
3. Identify the primary cause of ejection fatalities.
4. Identify the hazards of high and low altitude ejections.
5. Identify the T-37 recommended minimum ejection altitudes and the T-37 emergency minimum ejection altitudes.
6. Identify the procedures outlined in the T-37 Before Ejection If Time and Conditions Permit checklist.
7. Conduct ejection seat strap-in procedures.
8. Conduct an emergency ground egress.
9. Perform the procedures for ejection from the T-37

Assignment

1. Read JL0103 in the SG and answer the review questions.
2. Read Sections I and III, T.O. 1T-37B-1, *Flight Manual*

Introduction

An emergency situation requiring egress from your aircraft can occur at any time. It's your responsibility to know (without question) the procedures to effect a safe and successful egress. You cannot afford to take the attitude "it just won't happen to me." The egress may be on the ground while taxiing or inflight during a check ride. The major factor in delayed decision making is a loss of situational awareness of just how quickly the situation is deteriorating. The following information will provide you with the basic knowledge to determine the best course of action to egress in the shortest amount of time.

Information

Ground Egress

Goal 1 — Identify the purpose and function of specific components of the T-37 canopy system.

Goal 2 — Identify the purpose of T-37 ejection seat components.

Aircraft Canopy Operation

The T-37 canopy is operated electrically by direct current (DC) power and mechanically locked in the closed position by the canopy downlock handles prior to flight. It is wired directly to the battery and requires at least 20 volts to operate the canopy actuator motor. If the DC bus is energized and the battery switch is turned on, the DC bus supplies the electrical power required for canopy operation. The canopy weighs about 200 pounds.

Along with the electrical operation and mechanical locking of the canopy, the canopy can be opened during an emergency with a canopy breaker tool mounted in a bracket on the canopy bow; the canopy declutch T-handle located in a compartment on the left side of the cockpit; and the canopy jettison T-handle located forward of the canopy declutch T-handle. For more information on canopy operation, reference the T-37 *Flight Manual* and the T-37 Systems student guide.

Safety Pins

Flight status safety pins are inserted above the right handgrip of each seat and in the canopy jettison T-handle on the left side of the cockpit (when the aircraft is on the ground). During extensive maintenance, ground crews also install maintenance safety pins for seat and canopy initiators under the seat, the safety belt/man-seat separator initiator behind the seat, and the canopy remover at the top of the canopy activator mechanism. If any of the pins (with the exception of the safety belt/man-seat separator) are left in place, canopy jettisoning and or seat ejection are prevented. The handgrip safety pins do not prevent the canopy from jettisoning if the canopy jettison T-handle is pulled.

Ejection Seat Components

The ejection seat (Figure 3-1) in the T-37 catapults you clear of the aircraft at any speed, altitude, or attitude. Each seat accommodates a back parachute, provides an inertial reel-type shoulder harness, an automatic opening safety belt, and a seat-man separator. Manually adjust each seat up or down with the seat adjustment lever. The communication lead and oxygen hose connection unit is on the lower right side of each seat. The canopy initiator hose is contained in a quick disconnect plate on the left side. Both of these automatically disconnect with seat ejection. All seats have a canopy piercer on top of the seat to break the canopy for through-the-canopy ejection capability.

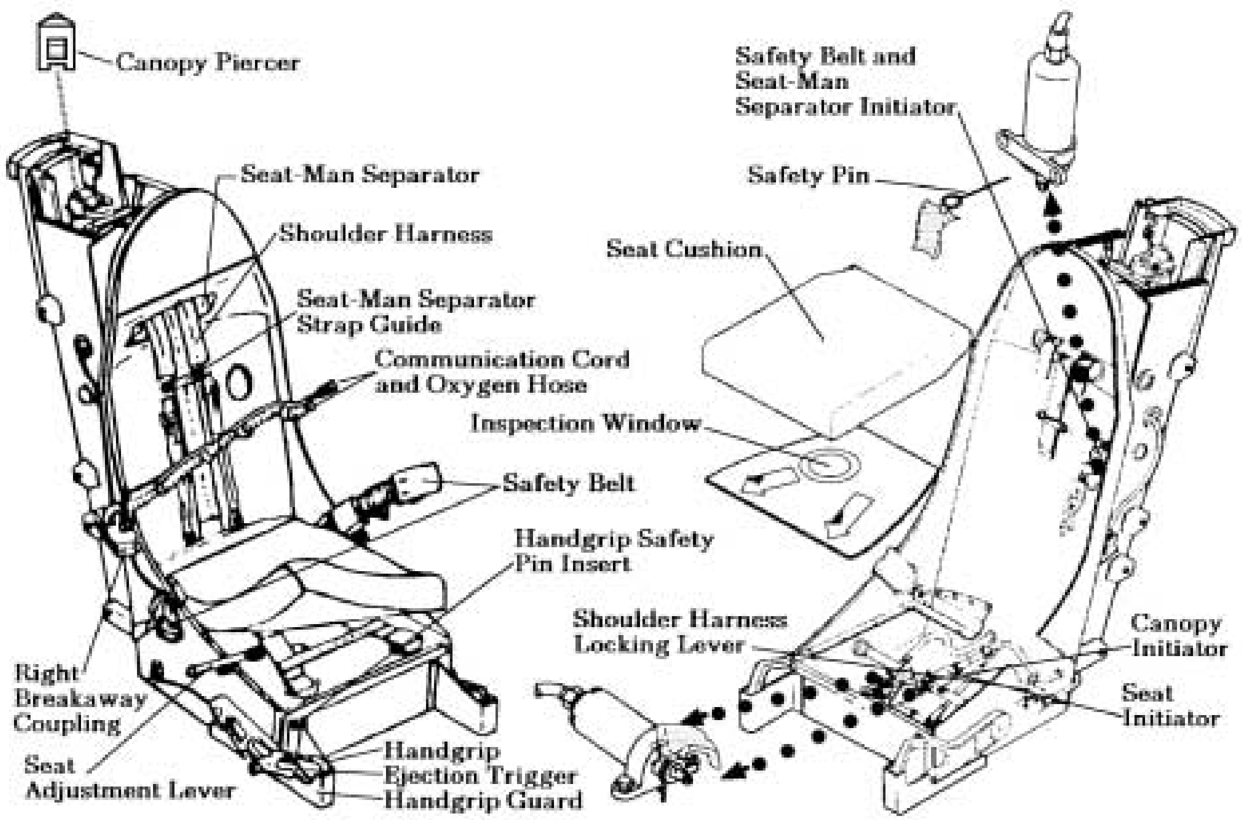

Figure 3-1 — T-37 Ejection Seat

Warning — *You must ensure the seat catches are engaged after a seat is adjusted up or down. If the catches are not engaged, the seat may not eject from the aircraft during ejection, or it may inadvertently move during flight.*

The ejection seat handgrips, when raised to the full up position, lock in position, expose the seat ejection triggers, and lock the shoulder harness. The handgrips are interconnected and rise together. The ejection triggers are located within the handgrips and are accessible only when the handgrips are in the full up position. Squeezing either trigger initiates the ejection sequence. The seat ejects approximately one-third of a second after the trigger(s) are squeezed. The through-the-canopy capability of the seat should prevent injury if the canopy fails to jettison (provided the helmet visor is down).

Ejection Seat Strap-in Procedures

Sitting in the seat with the parachute donned and secured, visually check the safety belt for any physical damage. Insert the belt link tongue on the right side of the belt successively through the right and left shoulder harness loops. Remove the silver key from its stowage snap (located beside the left canopy release on the parachute harness) and install it on the right side of the safety belt. Insert the belt link tongue fully into the manual release assembly on the left side of the belt until it closes.

Ensure positive locking by exerting pressure on the safety belt. Adjust the safety belt, then lock and adjust the shoulder harness.

Emergency Ground Egress

Reference T.O. 1T-37B-1, Section III, Emergency Procedures, for additional information. The following procedures should be followed if emergency ground egress is required from a T-37 aircraft.

Engine fire or overheat — If an engine fire or overheat detect warning light illuminates (steady or flashing) during engine start, or if there are visual indications of fire or overheat existing in the engine nacelles, proceed as follows:

1. Throttles — CUT-OFF.
2. Fuel Shutoff T-handles — PULL-OFF.
3. Battery/APU — OFF.

Egress — Cut off the throttles and pull off the fuel shutoff T-handles. Turn the battery switch OFF and insert the ejection seat safety pin (if time permits) before evacuating the aircraft. If the canopy is closed, normal electrical canopy opening should be attempted prior to using declutch or jettisoning the canopy. Varying circumstances will dictate how much of the above action can be accomplished.

Follow an orderly sequence. To clear the ejection seat — open the safety belt, clear the shoulder straps from the parachute harness, and disconnect the oxygen hose and radio cord. The fastest egress is accomplished with the parachute and parachute survival kit (if attached) on during ground egress.

Evacuate the aircraft and evacuate the area (do not return until the area is declared safe).

Canopy breaker tool — is installed in most aircraft equipped with an ejection seat to provide a last resort method of opening the canopy during ground egress. To break the canopy, grasp the canopy breaker tool with both hands. Be sure the curved edge of the blade is facing you. With an arm-swinging thrust using full body force, strike the canopy perpendicular to the surface. The blade alignment will determine the direction of the cracks. No set pattern of blows is necessary; normally, three or four blows will open an adequate escape hole.

Warning — *The canopy breaker tool can cause injury if the curved edge of the blade faces forward resulting in a glancing rearward blow.*

If a larger hole is desired after cracking the canopy, strike the canopy in a solid place around the perimeter of the hole. Breaking the canopy can be extremely difficult when ambient temperature is above 90°F.

Parachute retention — Normally, the parachute is retained during any ground egress to save time and provide protection. When the canopy breaker tool is used, a larger opening in the canopy is required. The hazard of accidental deployment of the parachute could also delay the exit. The choice of retaining the parachute or leaving it behind remains with you, determined by the circumstances. The mask and helmet should be retained for protection from flash fires.

Because of the danger of fire or explosion in or around an aircraft landing under emergency conditions, you should evacuate the immediate area as soon as ground egress is complete.

External opening of the canopy for emergency rescue — can be accomplished by fire department personnel, ground personnel, etc. If there is no evidence of fire, the canopy should be raised by opening the manual canopy release door; place the external canopy circuit switch to external; unzip the lining; release the canopy locks with the downlock handles; pull the declutch T-handle and lift the canopy. The canopy should be jettisoned only if there are indications of fire. Open the external jettison door and pull the external canopy jettison T-handle.

Inflight Egress

Goal 3 — Identify the primary cause of ejection fatalities.

Goal 4 — Identify the hazards of high and low altitude ejections.

Types of Ejection Systems

High performance jet aircraft require an escape system for inflight egress emergencies. Ballistic, rocket, and modular systems are currently used. Ejection systems differ in each type of aircraft and you must know the operation and limitations of your specific system. The modular and rocket systems will be discussed briefly. The ballistic system used in the T-37 will be discussed in detail.

Modular — In some high altitude or high airspeed egress situations, ejection forces exceed human tolerance and sophisticated devices must be employed for aircrew survival. To reduce egress stresses, a modular system was developed to separate the entire cockpit from the aircraft. Deceleration and stabilizing devices function automatically during the descent and the module then serves as a survival shelter on land or in water.

Rocket — ejection systems are designed to increase ejection apogee (the highest point of the seat trajectory) and provide a higher survivability rate under adverse ejection conditions. These systems are not foolproof; attention must be given to all aspects of the ejection. Some aircraft with tandem seating arrangements are equipped with sequenced ejection. This ejection system ejects the back seater first, providing protection from the rocket blast of the front seat. The T-38 employs a rocket ejection system, but does not incorporate automatic sequenced ejection.

Ballistic — ejection systems are designed to provide separation from aircraft surfaces and to overcome adverse G-force conditions. The rapid G-onset of ballistic systems requires the propellant charge to be low so human tolerances are not exceeded. This system provides minimal ejection apogee and has limited low altitude capability.

The ballistic catapult ejection system installed in the T-37 aircraft gives an average trajectory altitude of 43 to 60 feet above the aircraft in level flight. The minimum requirements for safe recovery by this ejection system are:

1. aircraft attitude — straight and level
2. altitude — 100 feet AGL
3. airspeed — 120 Knots Indicated Airspeed (KIAS)

These parameters apply if you are wearing a back parachute with the zero delay lanyard connected to the ripcord handle.

Ejection Factors

The ejection seat is designed to increase your survivability under adverse conditions. Reduced survival rates during low altitude ejections dictated the design of new escape systems that have the capability of low altitude and low airspeed recovery. These systems were designed with minimum time sequence factors for egress, seat separation, parachute deployment, and descent. Survival under ejection conditions is primarily dependent on the time required for complete parachute deployment. The time required from initiation of the ejection sequence until full parachute deployment is dependent on three factors — attitude, airspeed, and altitude.

Attitude — The attitude of the aircraft during ejection includes up vectors, down vectors, and bank angles.

1. Straight-and-level conditions. This flight attitude, with the necessary parachute deployment airspeed, is the minimum acceptable requirement for survival during low altitude ejections. Most systems will provide parachute opening at or above the ejection altitude and a safe recovery is generally ensured (Figure 3-2).

2. Up or down vectors. These factors are critical in determining the success of ejections. An up vector, or climbing aircraft (Figure 3-3), will provide the optimum situation for ejection. You will receive upward thrust from the seat propellant and the aircraft trajectory, providing parachute opening at the maximum possible altitude (if deployment airspeeds exist). A down vector, or diving aircraft (Figure 3-4) presents the worst situations for you during low altitude ejections. The propellant on the highest performance ballistic system cannot overcome the downward vector if minimal ground separation exists; parachute deployment will be restricted or may not occur at all. Ejecting out of the ejection seat's operating envelope is a major cause of low altitude ejection fatalities.

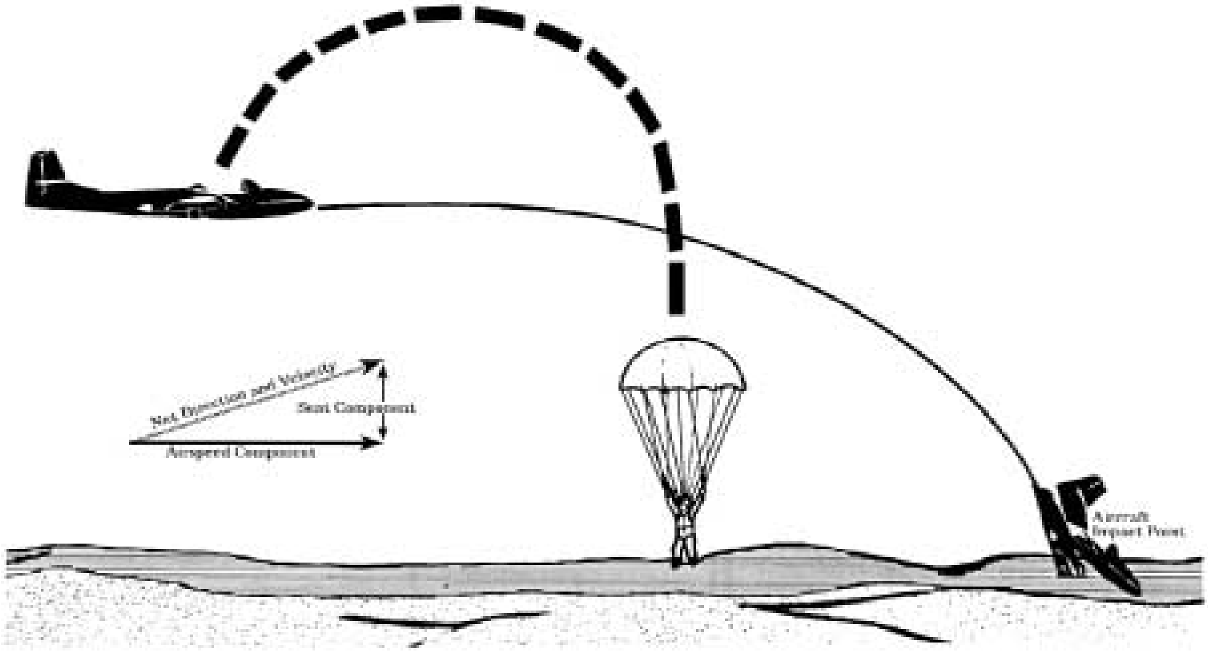

Figure 3-2 — Straight and Level Conditions

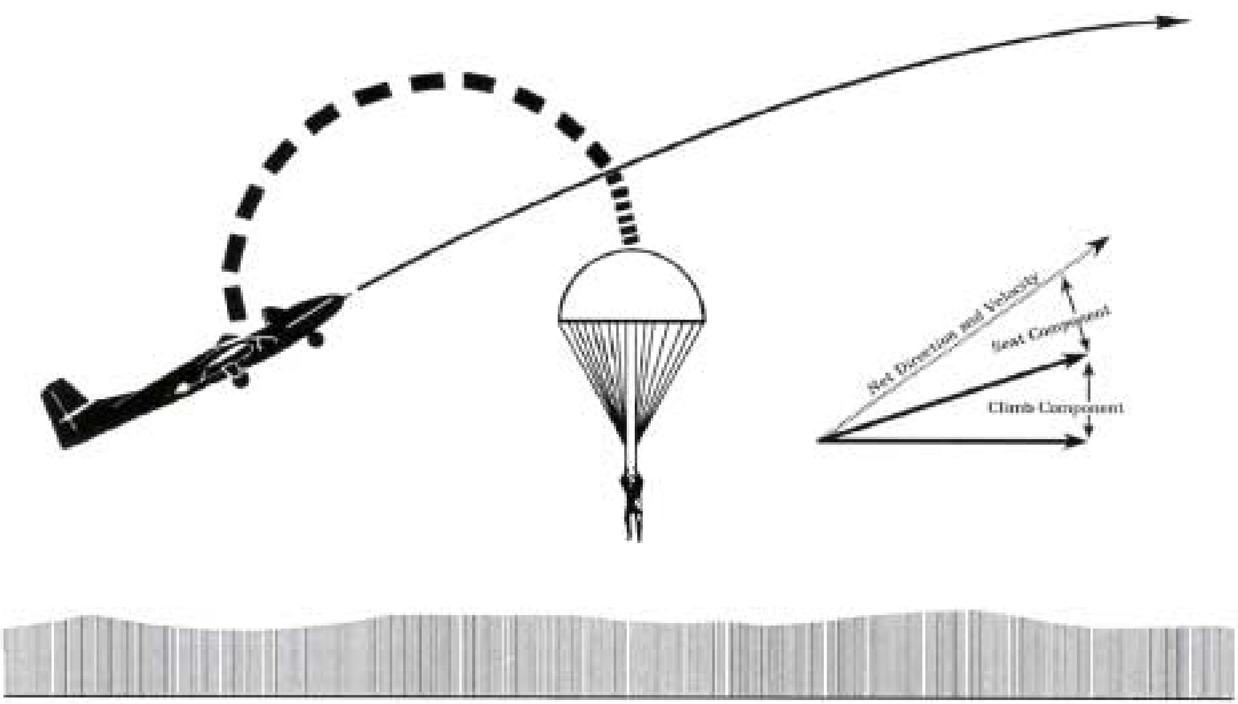

Figure 3-3 — Up Vector

Flight Condition	Pitch	Bank Angle	Airspeed (KIAS)	Sink Rate (FPM)	Minimum Ejection Altitude (Ft AGL)
Inverted Accelerated Spin	-70°	0°	100	15,585	4200
Normal Erect Spin	-45°	0°	30	10,417	3400
Dive	-60°	0°	350	30,500	6800
Dive	-30°	0°	350	17,730	4400
*Flameout Glide	-4°	0°	125	885	300
*Final Turn	-8°	35°	110	1560	500
*Final	-5°	0°	100	885	300
*Zero delay lanyard connected.					

Figure 3-4 — Ejection Capabilities

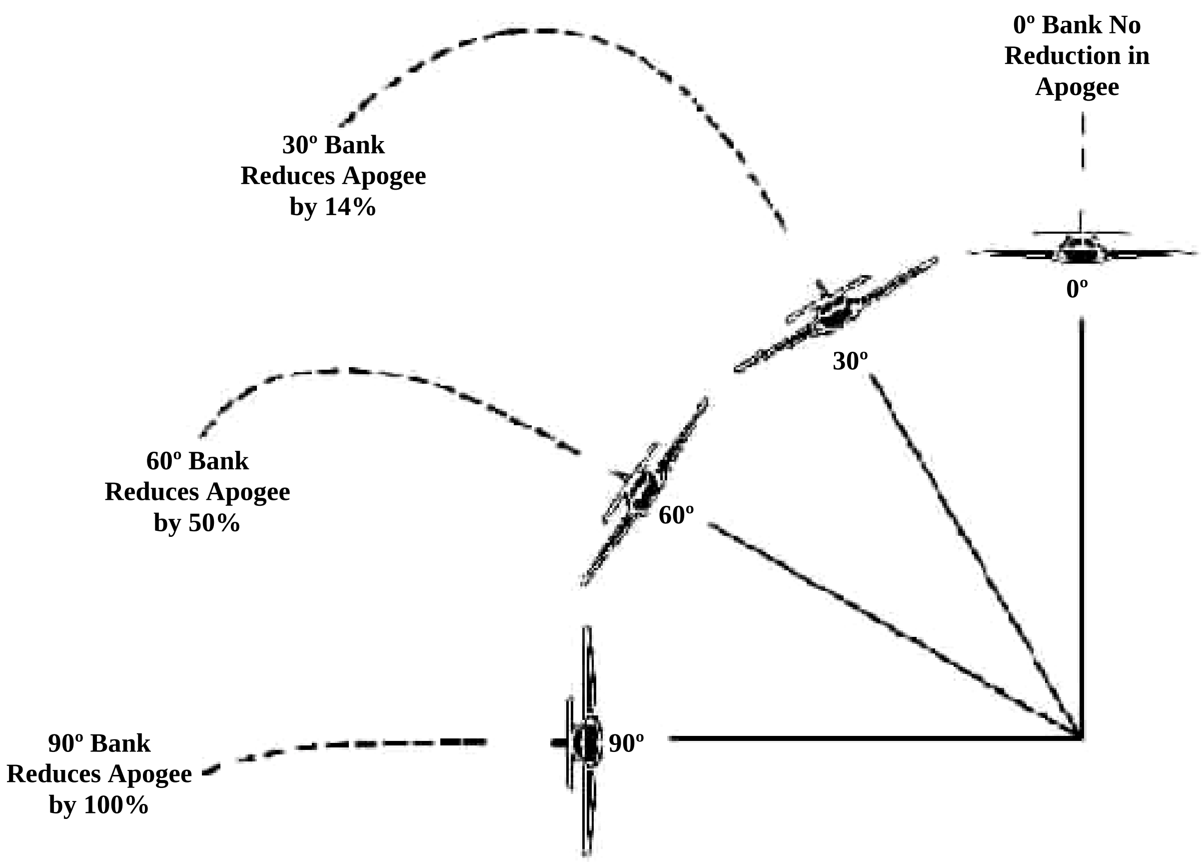

Figure 3-5 — Effect of Bank Angle

3. Bank angle. The aircraft bank angle drastically affects the height attained by the ejection seat. At a bank angle of 60 degrees, 50 percent of the ejection height may be lost. At 90 degrees of bank, height that should be attained by the ejection seat is totally lost (Figure 3-5).

Airspeed — The required airspeed relates to parachute opening time and not to aircraft performance. Increased airspeeds result in reduced parachute opening times, a significant factor during low altitude ejections. However, excessive airspeeds contribute to increased injury potential when you are exposed to the airstream during ejection.

Altitude — The absolute minimum altitude required for safe recovery usually depends on the height the ejection seat can be propelled by the catapult. A T-37 ballistic catapult provides an apogee of 43 to 60 feet. A T-38 rocket catapult provides an apogee of 160 to 200 feet under similar conditions.

Attitude, airspeed, and altitude factors are interrelated. If a bank angle or dive attitude exists, a correspondingly higher altitude is required for a successful ejection and recovery. If airspeed is higher than recommended in the flight manual for a particular bank angle or dive attitude, a higher altitude (or a climb attitude) must exist.

Zoom maneuver — The zoom maneuver exchanges excess airspeed for an up vector or improved ejection attitude. During critical phases of flight, such as takeoff, landing, and low altitude operations, it becomes imperative that any down vector be eliminated by trading excess airspeed for an up vector. If possible, an up vector with wings-level attitude should be established to provide maximum time for parachute deployment.

Warning — *Do not zoom to the point of establishing a sink rate.*

Human Factors — Decision to Eject

The problems and stresses imposed on you during an ejection must be known and understood. The number one cause of ejection fatalities is a crewmember's inability to make a timely decision to eject. This delayed decision to eject usually removes the aircraft from its ejection envelope, resulting in loss of life.

A timely decision to eject is the most important factor in determining the success or failure of ejection. Unless the aircraft is uncontrolled, has exploded, or has been involved in some other catastrophe, the ejection decision is often extremely difficult. Most fatal ejections occur when attempted below 500 feet AGL. In a controlled aircraft, it's recommended that ejection be initiated no lower than 2,000 feet AGL. Ejecting at higher altitudes (more than 2,000 feet AGL) should be considered to provide time to correct possible parachute equipment malfunctions after ejection. It's apparent that the ejection decision is often delayed until no margin for errors or equipment malfunctions remains.

For example, an instructor pilot (IP) and student pilot (SP) were flying a T-37 presolo contact training sortie. The IP demonstrated traffic pattern stalls, slow flight, and straight ahead power-on stalls. Following the demonstrations, the SP attempted power-on stalls. On the SP's second attempt, the IP who had been giving maximum assistance, assumed full control of the aircraft just before or at the stall. The aircraft entered into a series of nose-low unusual attitudes during which the IP ordered the SP to eject. The SP ejected successfully and was found with only minor injuries. The IP did not or could not recover the aircraft from the ensuing high-speed dive. Although the IP initiated ejection, the sequence was terminated by ground impact resulting in fatal injuries. *The IP's decision to stay with the aircraft and possible attempt to recover removed the IP from the ejection envelope.*

There are many factors that contribute to a crewmember failing to make a timely decision to eject. These factors include:

1. inadequate knowledge of the escape system.
2. poor crew coordination.
3. over concentration — channelized attention.
4. lack of situational awareness — out of the ejection envelope.
5. emergency recognition.
6. inability to overcome problems inflight.
7. mission requirements.
8. avoidance of populated areas.
9. pressing.

10. stigma.
11. well dones.
12. Flight Evaluation Board (FEB) fears.
13. ego.
14. command emphasis.

In making a quick and correct decision regarding egress, you must develop a complete knowledge of the aircraft and an understanding of normal and emergency procedures. It is necessary to know the capabilities and the limitations of individual escape systems. This knowledge is usually acquired during initial training but must be continuously reviewed. You must decide under what conditions you will stay with the aircraft and under what conditions you will leave it. This decision must be made *before* you strap into your aircraft. This ejection decision should be based on your level of knowledge, limitations, experience, and confidence in and respect for the aircraft and its ejection system.

Pre-ejection considerations

The exact sequence of events during ejection varies with each aircraft. However, if time and altitude permit, there are many precautions that can be taken before the ejection process is initiated. Some of these are:

1. wear appropriate clothing (boots, gloves, etc.).
2. fit the parachute harness properly.
3. secure loose equipment before ejection.
4. tighten mask (to 3rd or 4th click of properly fitted mask).
5. coordinate with other occupants before ejection.
6. advise other aircraft or ground stations of possible location of ejection.
7. reduce airspeed to minimize windblast (120 knots minimum).
8. if at low altitude, zoom the aircraft to exchange airspeed for altitude.
9. trim so there are no abrupt pitch changes when the control stick is released. Ejection should be accomplished while aircraft is in a wings level climb at a minimum airspeed of 120 knots.
10. assume proper body position for ejection — feet and knees together, head back, visor down, chin strap fastened, mask secured.

Note — The stick may prevent you from getting your feet and knees completely together.

Causes of Ejection Injuries

Many injuries sustained during ejections are compression fractures of the vertebrae due to improper body position. Poor body position is usually attributable to undesirable aircraft attitude, insufficient time for preparation, inability to use the headrest when G-forces or aircraft rotation exists, and leaning forward to reach the ejection handgrips/triggers.

Body position — To prevent injury during egress, a position providing the maximum vertical vertebral alignment of the spine is desired. The buttocks should be pressed firmly against the seat back, the spine should be straightened against the seat back, and the head should be pressed to the headrest. The spine will then easily sustain the transmission of ejection acceleration forces.

The legs/feet should be drawn back to the front of the seat before ejection to minimize leg injury. Tests revealed that if the feet remain on the rudders prior to ejection, the legs would swing back against the seat when the seat moves up the rails. This movement may bruise the calf of the leg but it usually does not cause incapacitating injuries. Some aircraft have garters or reels to retract the feet during ejection.

The use of seat cushions also affects human tolerance to upward ejection. If excessive amounts of compressible material are placed between the buttocks and the seat, the body will tend to remain stationary for a time after the catapult begins to accelerate the seat. The sudden G force experienced by the occupant will then be greater than those actually produced by the catapult and may exceed human tolerance. All crewmembers must only use cushions, survival equipment, or parachutes in combinations specified by appropriate aircraft flight manuals.

Flailing injuries — are caused during high speed, high altitude egress. When your feet and legs are not held together and your arms are not held closely to your body, injury can occur. Coupled with the windblast, poor body position can dislocate the shoulder or hip and tear muscles. Windblast has also contributed to the removal of masks and helmets during ejection.

Tumbling and spinning — of the ejection seat and occupant after egress depends on the design of the seat, the type of aircraft, the speed of ejection, and the altitude of the aircraft. The highest tumble rate observed during extensive tests has been 180 rpm, decreasing rapidly as the seat decelerates. In test ejections, volunteers reported they were not aware of tumbling if they focused their attention on the lap belt or some part of the seat.

After live emergency ejections, a number of crewmembers reported severe tumbling while still in the seat. In two cases, tumbling may have caused delay in separating from the seat. In an unstable seat, the situation may be more serious during prolonged descent. The radial acceleration produced by prolonged tumbling may be sufficient to cause circulatory failure, unconsciousness, and to a lesser degree, confusion and disorientation.

Besides head-over-heels tumbling (common following ejection), an individual may also experience a flat spin during a prolonged free fall. In a flat spin, the body is essentially horizontal to the Earth's surface and rotates rapidly in the horizontal plane. A spin may be slowed or broken by assuming the spread eagle position. Note, however, that the body orientation to the earth in this position greatly depends on equal positioning of the body. Keep the spine arched to the rear and the arms and legs spread equally.

Improper PLFs — Even though the most severe injuries may occur during initial ejection from the aircraft, the highest percentage of injuries during the entire ejection sequence are suffered while performing the PLF. The emergency is not over after successfully separating from the seat, free-falling (if necessary) to a safe altitude, and performing parachute manipulations. You still must concentrate on your final impact with the ground. Looking at the ground and not keeping the feet and knees together cause most PLF injuries.

High Altitude Egress

The automatic parachute was designed to solve three problems associated with high altitude ejection — high opening shock, hypoxia, and frostbite. Delayed parachute opening is used to minimize opening shock by allowing you to free-fall to a terminal velocity well within physiological tolerances.

Hypoxia and decompression sickness — Retaining and properly using oxygen equipment allows you to overcome hypoxia during high altitude ejections. The emergency oxygen cylinder in the parachute pack supplies a sufficient amount of oxygen to free-fall to a safer altitude. The free fall and emergency supply of oxygen will also reduce the effects of decompression sickness during high altitude egress.

Frostbite — Descent from FL450 under parachute canopy could require up to 25 minutes, exposing the body to low temperatures (-55° Celsius). Frostbite can be minimized by wearing proper clothing and by free-falling to approximately 14,000 feet MSL prior to parachute deployment.

Free fall — Regardless of the method used to egress an aircraft at high altitude, you must free-fall to a lower altitude to avoid hypoxia, decompression sickness, frostbite, and high G force during parachute deployment. Since it's difficult to determine altitude and sometimes impossible to activate the ripcord because of injury or unconsciousness, the automatic ripcord release/timer is installed on USAF parachutes to provide free fall to 14,000 feet MSL. This timer provides altitude control for free falls, and time control from high-speed ejection to terminal velocity, thereby reducing parachute-opening shock.

Low Altitude Egress

Many egress problems occur at low altitudes. Low altitude is defined as any altitude not providing necessary air-to-ground separation for safe recovery from an uncontrolled aircraft. This altitude relates to aircraft performance and will vary by aircraft type. Very low altitude is defined as 500 feet AGL or less. Several timesaving devices have been incorporated into egress systems to increase the success rate of low altitude ejections.

Zero delay lanyard — was developed to provide a low altitude escape capability. This system uses a detachable zero delay lanyard that must be connected to the ripcord handle to provide immediate parachute activation after seat separation. Seat separation causes both arming knob and ripcord handle to be pulled simultaneously. The ripcord handle pulls the parachute pins providing zero delay chute deployment. Above 10,000 feet MSL, the zero delay lanyard hook is disconnected from the ripcord handle and connected to the stowage ring. Remember, connecting or disconnecting the zero delay lanyard to/from the ripcord handle must be done manually by the crewmember.

Note — Disconnect the zero delay lanyard when climbing to high altitudes (through 10,000 feet MSL). Immediate opening of the parachute above 14,000 feet MSL may result in serious or fatal injury. When ejecting under controlled conditions and at more than 2,000 feet AGL, disconnect the zero delay lanyard. Doing so allows an additional second between man-seat separation and parachute deployment, reducing the possibility of seat-chute entanglement.

Automatic ripcord release/timer — is a self-contained unit and is located in the upper left corner of the back parachute. The release can be operated manually by activating the arming knob. But, during ejection the arming lanyard anchor (silver key) should automatically accomplish the same operation. The silver key is connected to the arming knob and also attached to the swivel link of the safety belt. Upon seat separation, the silver key serves as a static line to arm the automatic ripcord release/timer. The parachute will then deploy at a preset altitude of 14,000 feet MSL, or after 1 second if below 14,000 feet MSL.

Ejection Procedures

Goal 5 — Identify the T-37 recommended minimum ejection altitudes and the T-37 emergency minimum ejection altitudes.

Goal 6 — Identify the procedures outlined in the T-37 Before Ejection If Time and Conditions Permit checklist.

Recommended Minimum Ejection Altitudes

The T-37 is equipped with an upward ballistic ejection seat and it's important for you to know its limitations. Minimum ejection altitudes are dependent on dive angle, airspeed, and bank angle. The recommended minimum altitudes are:

1. Controlled conditions **—** 2,000 feet AGL

2. Uncontrolled conditions — 10,000 feet AGL

Prior to ejection, reduce your airspeed as much as possible by trading airspeed for altitude. Accomplish the ejection at the existing airspeed if the aircraft is uncontrollable. Do not delay your ejection below 2,000 feet AGL and do not manually open your safety belt before ejection. There is a progressive decrease in survivability below 2,000 feet AGL and manually opening the safety belt eliminates the automatic opening feature of the parachute.

Emergency Minimum Ejection Altitudes

Emergency minimum ejection altitudes of the T-37 are based on straight and level flight at 120 KIAS or above. The emergency minimums are

1. zero delay lanyard disconnected (1 second parachute) — 200 feet AGL.

2. zero delay lanyard connected (0 second parachute) — 100 feet AGL.

Warning *— The emergency minimum ejection altitudes are given only to show low altitude ejection can be accomplished in case of an emergency requiring immediate ejection. They must not be used as a basis for delaying ejection when above 2,000 feet AGL.*

Here's your bottom line **—** if your aircraft enters uncontrolled flight above 10,000 feet AGL, attempt recovery. However, do not go below 10,000 feet AGL with additional attempts at recovery. If your aircraft enters uncontrolled flight below 10,000 feet AGL, **EJECT IMMEDIATELY**.

Before Ejection (if Time and Conditions Permit)

The following actions should be accomplished before a controlled ejection from a T-37 aircraft if time and conditions permit:

1. Turn IFF to EMERGENCY.

2. Notify appropriate ground agency of ejection (include type of aircraft, number of occupants, location, and altitude).

3. Stow all loose equipment.

4. Disconnect zero delay lanyard, lower helmet visor(s), and tighten oxygen mask and chin strap securely.

5. Turn aircraft toward uninhabited area.

6. Actuate emergency oxygen cylinder (high altitude).

7. Attain proper airspeed, altitude, and attitude.

Note — If zooming the aircraft, apply trim to prevent pitch down when the control stick is released for ejection.

8. Disconnect oxygen hose and radio cord.

Ejection

1. **HANDGRIPS — RAISE**

Warning — *Sit erect, head firmly against headrest, feet back.*

2. **TRIGGERS — SQUEEZE**

When raised to the full up position, the ejection seat handgrips lock in position, expose the seat ejection triggers, and lock the shoulder harness. The handgrips are interconnected and rise together. The ejection triggers are located within the handgrips and are accessible only when the handgrips are in the full up position. Squeezing either trigger initiates the ejection sequence. The seat ejects approximately one-third of a second after the trigger(s) are squeezed. The through-the-canopy capability of the seat should prevent injury if the canopy fails to jettison (provided the helmet visor is down).

Warning — *Both triggers should be squeezed simultaneously when possible. If only one trigger is squeezed, the fingers of the opposite hand must not be between the handgrip and the trigger. This could cause the seat to malfunction or not fire at all.*

As the seat moves up the rails, a one-second delay initiator is triggered and fires the safety belt. The man-seat separator assists, but does not ensure seat separation. Every effort should be made to manually separate from the seat to back up the automatic sequence.

After Ejection

Safety belt — Attempt to open manually.

Separate from the seat — A determined effort must be made to separate from seat to obtain full parachute deployment at maximum terrain clearance. Separating from the seat is extremely important for low altitude ejections.

If the safety belt is opened manually — above 14,000 feet MSL, immediately pull the parachute arming lanyard knob. Below 14,000 feet MSL, pull the ripcord handle.

Notes — (1) If the safety belt does not open, automatic seat separation will not occur. You must then manually open the safety belt and immediately push away from the seat. If you manually open the safety belt, you MUST manually operate the parachute. (2) During low altitude ejections pull the ripcord immediately after separating from the seat. This is a precautionary measure in case the automatic ripcord release/timer or zero delay lanyard fails to open the parachute. (3) If over water, actuate underarm life preserver as soon as possible after parachute opening.

In summary, there are six basic steps that should be accomplished to effect a successful ejection, whether it be uncontrolled or controlled. These steps are

1. raise the handgrips.
2. assume proper body position.
3. squeeze the triggers.
4. attempt to “beat the system.”
5. separate from the seat.
6. above 14,000 feet MSL — pull the parachute arming lanyard knob; below 14,000 feet MSL — pull ripcord handle.

Bail Out if Seat Fails to Eject

If the seat fails to eject when the triggers are squeezed, a manual bailout will be required. Proceed as follows:

1. Reduce airspeed as much as practical.
2. Release the safety belt, shoulder harness, radio, and oxygen connections.
3. Jettison the canopy.

4. If the aircraft is controllable, trim full nose down and apply backpressure to attain a nose-high attitude.

5. Abruptly release the stick and push free.

6. If the aircraft is not controllable, bail out by diving over the trailing edge of the wing.

7. Above 14,000 feet MSL — pull the parachute arming lanyard knob; below 14,000 feet MSL — pull the ripcord handle.

T-37 Procedures Trainers

Goal 7 — Conduct ejection seat strap-in procedures.

Goal 8 — Conduct an emergency ground egress.

Goal 9 — Perform the procedures for ejection from the T-37.

After you have completed *The Parachute* and *T-37 Egress* lessons you will be scheduled for at least two attempts to perfect ejection procedures using a T-37 procedural seat trainer. During this training, you will be expected to show proficiency in completing equipment connections, seat strap-in procedures, and ejection/ground egress during an emergency.

Summary

While the T-37 is a relatively safe airplane, emergencies do occur where emergency ground egress or ejection are required. The better you know the capabilities and limitations of the T-37 ejection system, the better your chances for a successful ejection; a delayed decision to eject is the number one cause of ejection fatalities. The ballistic seat in the T-37 incorporates automatic lap belt opening, seat-man separation, and arming of the automatic ripcord release/timer. However, an attempt to accomplish these actions manually should be made in case the automatic feature fails. Certain actions can be taken to increase the effectiveness of ejection; however, ejection should never be delayed for checklist items. Aircraft attitude, altitude, and airspeed as well as controllability all affect the ejection capabilities of the seat. The bottom line is that you, as the pilot, must make the decision to eject when appropriate; you should never delay ejection until you are below the recommended minimum altitudes.

Review Exercise JL0103

Complete the following review exercise by choosing the correct answer(s) or filling in the blanks.

1. Your first two procedures during any T-37 emergency ground egress are:

   a. Battery/APU — OFF and seat safety pin inserted.

   b. THROTTLES — CUT-OFF and FUEL SHUTOFF T-HANDLES — PULL-OFF.

   c. Disconnect personal leads and open aircraft canopy.

   d. HANDGRIPS — RAISE and TRIGGERS — SQUEEZE.

2. Complete the following statements concerning the minimum requirements for safe recovery from the T-37 ejection system.

   a. Aircraft Attitude — ____________________ and ____________________

   b. Altitude — ____________________ feet AGL

   c. Airspeed — ____________________ KIAS

3. The number one cause of ejection fatalities is the crewmember's inability to make a timely ____________________ to ____________________.

4. If your aircraft enters uncontrolled flight above 10,000 feet AGL, attempt ____________________. However, do not descend below 10,000 feet AGL. If your aircraft enters uncontrolled flight below 10,000 feet AGL, ____________________ ____________________.

5. Number the following statements in their order of occurrence during a T-37 ejection.

   a. _____ **TRIGGERS — SQUEEZE**

   b. _____ Safety belt fires and man-seat separator assists seat separation.

   c. _____ Triggers exposed and shoulder harness locked.

   d. _____ **HANDGRIPS — RAISE**

   e. _____ Canopy is jettisoned.

   f. _____ Catapult is fired and seat moves up the rails.

6. Complete the following statements for a controlled ejection from a T-37 aircraft (if time and conditions permit):

   a. Turn IFF to ____________________.

   b. Notify appropriate ground agency of ____________________ (include type of aircraft, number of occupants, location, and altitude).

   c. Stow all loose____________________.

   d. Disconnect ____________________-____________________ ____________________, lower helmet visor(s), and tighten oxygen mask and chin strap securely.

   e. Turn ____________________ toward uninhabited area.

   f. Actuate ____________________ ____________________ ____________________ (high altitude).

   g. Attain proper airspeed, altitude, and ____________________.

   h. Disconnect ____________________ hose and radio ____________________.

Lesson JL0104 — 2.0 Hours

Live Fire Ejection Seat

Goal

Using a MH-15 live fire ejection seat indoctrination trainer or similar indoctrination trainer, demonstrate proper body position for ejection and perform an ejection.

Assignment

Read JL0104 in the SG.

Introduction

The only sure method of escape from a disabled aircraft flying at high speeds and low altitudes is the use of the aircraft ejection seat. Ejection seat procedural training is indispensable to your safety as a crewmember because it familiarizes you with proper sequential egress procedures, establishes confidence in the ejection system, and establishes confidence in your ability to use it.

Information

Training Method

Ejection seat training will be conducted with safety as the number one priority. To increase safety we will provide you with a basic understanding of the operation of the trainer. The basic component parts of the MH-15 or similar ejection seat trainer (Figure 4-1), are the tower and supporting beam assemblies, the cab assembly, the hydraulic system, the instructor panel, and the catapult assembly.

The tower supports a two-rail track that guides the ejection seat in its trajectory. The supporting beams brace and support the tower when it is raised to firing position. The cab assembly of the ejection seat trainer is mounted on the base of the tower, simulating an operational jet aircraft cockpit and contains the ejection seat. The hydraulic system is used to raise and lower the ejection seat for loading and firing. The instructor panel is mounted on the forward end of the cab and provides a sequential check of proper student pre-ejection operations by the orderly illumination of particular warning lights. The catapult assembly uses the energy produced by compressed gas to propel the ejection seat up the tower rails.

Ejection Seat Training

No training will be accomplished until a thorough inspection of the ejection seat trainer, including test firing, has been completed. A briefing will be given by qualified aerospace physiology personnel on the purpose of the ejection seat trainer, its operation, and its comparison with the actual aircraft ejection seat. This briefing will include questioning for any physical condition that may preclude safe accomplishment of this training (displaced spinal disc; history of skull, spine, or pelvic fracture; pilonidal cysts, etc.)

Pre-fire Position

Following the orientation briefing, the ejection seat is raised to the pre-fire position and you are seated. After you are secured in the seat and prior to lowering you into the cockpit, you must demonstrate the following proper body position steps for ejection:

1. Safety belt and shoulder harness secured
2. Torso and buttocks as far back in the seat as possible
3. Back straight and against seat back
4. Head pressed back firmly against headrest

Figure 4-1 — Live Fire Ejection Seat

5. Feet back against the front of the seat
6. Knees together (as much as the stick will allow)
7. Elbows in with arms in arm rests

The instructor will then brief the pre-ejection procedures, the ejection sequence, and the correct pre-ejection body position. The ejection seat is then lowered to the firing position. The primary instructor monitors all procedures on the illuminated panel.

Ejection Procedures

The following procedures are typical of those that should be accomplished in the conventional ejection seat trainer.

1. Throttle back — reduce airspeed.
2. Activate emergency oxygen.
3. Jettison canopy and arm seat (may be two separate functions on certain trainers).
4. Assume correct firing position (proper body position).

Note — Correct body position is given a final check by the primary instructor and then the instruction "fire when ready" is given.

5. Squeeze the trigger(s) to fire the seat.

Following the ejection and ride up the tower rails, the seat and occupant will return to the pre-fire position where debriefing and ground egress will take place.

Lesson JL0105 — 1.0 Hours

T-37 Survival Equipment

Goals

1. Identify survival requirements, resources, and conditions of the local area.
2. Identify survival equipment located in the parachute.
3. Identify components of the parachute spacer kit.
4. Identify suggested items for the personal survival kit.

Assignment

Read JL0105 in the SG and answer the review questions.

Introduction

Meeting the two basic needs of health (physical and psychological) and communications (signaling) must be accomplished during a successful short-term survival episode. Personal life support equipment will help fulfill some of these needs. Learn to use issued equipment, but don’t expect it to provide for your every need. Supplement this equipment with a personal survival kit, read information on survival experiences and techniques, and learn about your local area. Previous survival training experience is advantageous, but the importance of being mentally and physically prepared cannot be overemphasized. Remember, there is no substitute for ingenuity.

Physical preparation encompasses both personal muscle conditioning and the availability of supplies or equipment necessary to provide for daily human requirements of water, food, shelter, and warmth. Many aircrews that have publicly stated, “it won’t happen to me” have, abruptly and with little advance warning, been thrust into survival situations — unprepared! Many did not survive and many others survived only because of rapid and successful rescue efforts. So, be prepared for the worst and rejoice if it doesn’t occur. Don’t be complacent!

Information

Local Requirements

Goal 1 — Identify survival requirements, resources, and conditions of the local area.

Local Area

The majority of your sorties (in the T-37) will be flown in the local area, within approximately 100 miles of your base. However, once you begin the next phase of training you will leave the local area on extended training missions, out-and-backs, and cross-country flights. The more you know about the environment (climate, terrain, life forms) of the area you fly over, the better you can help yourself in a survival situation. The climate, terrain, and wildlife of each area present individual and unique hazards.

Significant Areas and Resources

Your instructor will provide specific information on local areas of sparse population (controlled bail-out areas), highways, water resources, restricted, and critical areas.

Search and Rescue (SAR) Procedures

The probability of you applying long-term survival training concepts under noncombat conditions continues to decrease as rescue aircraft and equipment become more sophisticated. However, you must still be prepared!

Prior to bailout, a radio call declaring the emergency will activate the SAR system. If the radio call is not successful, the system will be activated when your personal locator beacon in the parachute pack is deployed. Your Air Force installation may be assisted by sister services, federal, state, county, or local governmental, commercial, or private organizations in the SAR effort. Your responsibilities to the survival effort begin at the onset of the emergency and continue until you are rescued.

Equipment

Goal 2 — Identify survival equipment located in the parachute.

Goal 3 — Identify components of the parachute spacer kit.

Goal 4 — Identify suggested items for the personal survival kit.

The parachute pack and survival kits contain equipment to satisfy the needs of water, food, shelter, etc. Sometimes, this equipment may not be available because of damage or loss. Along with knowing the location, care, and use of issued equipment, you must know methods of improvisation when the needed equipment is not available.

The Parachute

The parachute consists of the pilot chute, canopy, and fourteen suspension lines. The harness contains risers, webbing, buckles, snaps, D-rings, and other hardware. The entire parachute assembly is a survival resource and every piece of material and hardware can be used. Determine your needs for signaling, shelter, etc., before disassembling the parachute to provide maximum use of the material and hardware.

Hook blade knife and pocket assembly — is located on the right front riser and is primarily used for cutting suspension lines to correct canopy malfunctions.

Flare and mirror pocket — is located on the right side of the parachute pack at the hip. This pocket contains a personnel distress signal kit, an emergency signaling mirror, and a general purpose knife.

Personal locator beacon — is located within the upper right corner of the pack and is activated when the parachute canopy is deployed.

AFP 64-15 — *Survival and Emergency Uses of the Parachute*, is located in a sleeve beside the personal locator beacon in the pack. The pamphlet provides basic information on survival with useful information on the parachute and other survival techniques.

Note — The emergency oxygen assembly has proved to be useful in survival situations. If the oxygen has not been depleted, it can be used for the treatment of shock. A slingshot can be improvised from the rubber hose, and it can be used as a pounding tool if it is empty.

Survival kit, parachute pack, SRU-16/P — or minimum survival kit is located in a pocket next to the personal locator beacon and AFP 64-15. It is accessible only after parachute deployment and normally cannot be reached when wearing the parachute.

The minimum survival kit is intended to help you for only a very brief survival period. However, if used properly, it can support a prolonged period. The following items are standard in this kit:

1. Instruction sheet
2. Ten matches
3. Three or four fire starters
4. Two striker strips
5. One pocketknife
6. Two safety pins
7. Two needles
8. Two bandages
9. One compass
10. Three fish hooks

***Note* —** The SRU-16/P kit may also contain snare wire or a water bag, depending on the year it was manufactured.

The most alarming statement from survivors who had this survival kit available was that few of them used it. Many did not remember it while others could not locate it! Not using the kit was common in many of the escape and evasion situations in the Southeast Asia conflict. Remember, in a survival situation, **USE EVERY POSSIBLE RESOURCE!**

Parachute Spacer Kit (PSK)

Additional survival equipment can be carried in either the Survival Vest or PSK. These kits are most often worn on cross-country, low-level, out-and-back, and solo flights. The survival vest and PSK contain these standard items in AETC:

1. One survival radio, AN/PRC-90
2. One first aid kit
3. One whistle (plastic)
4. One tubing, latex, 6 feet.
5. One signal flare, MK-13 or MK-124
6. Three or four flexible packaged drinking water, 12 oz.
7. One 4'x4' plastic sheet or transpiration bag, rough translucent
8. One blanket, combat casualty

Note — The survival vest contains two of the MK-13 or MK-124 signal flares. The 4'x4' sheet of translucent plastic may be substituted with a clear plastic trashcan liner for use as a water transpiration bag. Optional items may be authorized.

The PSK attaches to two accessory D-rings on the parachute harness on the bottom of the parachute pack. The survival vest is donned before and worn under the parachute. Figure 5-1 shows the location of survival equipment in the parachute pack and the attachment of the PSK.

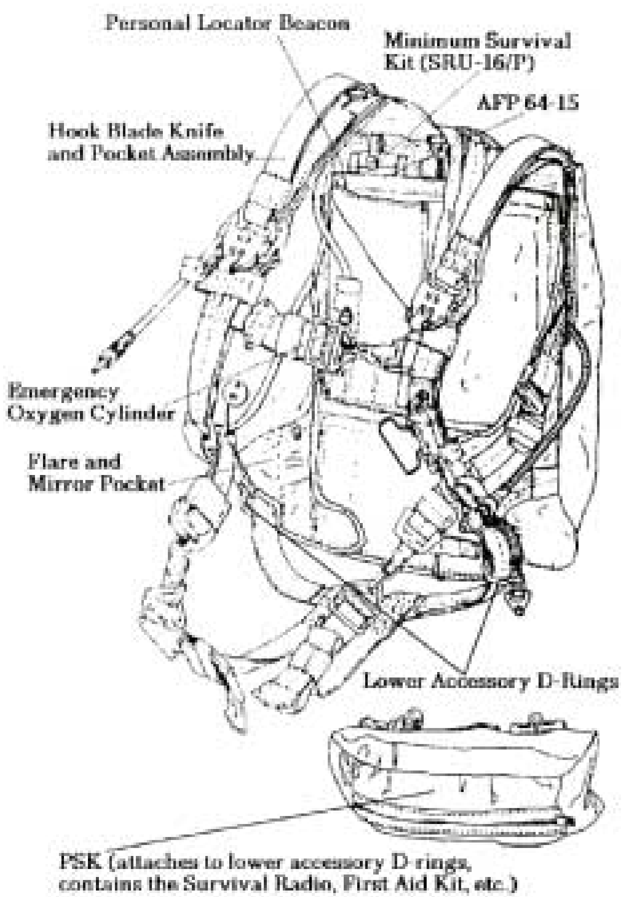

Figure 5-1 — Survival Equipment Location

Personal Survival Kit

Even though issued survival kits are available, you should seriously consider assembling and carrying a personal survival kit. Survival experiences have occurred where survivors have lost their issued kits. A personal survival kit in a pocket may considerably improve your chances of survival.

Guidelines — When you prepare a personal survival kit, think about your potential needs. Consider your environment, the type of mission you are flying, the availability of rescue vehicles and personnel, and how far you may need to travel to make contact with people.

Carry your personal survival kit by packing all the items in one or two waterproof containers or scatter the items throughout your clothing. Plastic cigarette cases, soap dishes, and freezer bags make excellent containers.

Suggested items — Examples of items that can be packed into a small container include

1. matches (in waterproof container).
2. magnesium stick — fire starter.
3. prophylactic (waterproof containers or canteen).
4. bouillon cubes.
5. salt.
6. needles (large enough eye to allow inner cord of parachute suspension line to pass through).

7. BAND-AIDS® or similar item.
8. aluminum foil (for cooking and signaling).
9. insect repellent stick.
10. Chap Stick® or similar item.
11. soap (antiseptic).
12. iodine.
13. magnifying glass (fire).
14. vitamins.
15. candy.
16. small toothbrush.
17. tea or coffee (soluble).
18. sugar.
19. powdered onion.
20. razor blade.
21. whistle.
22. adhesive tape.
23. nails.
24. clear plastic bags.
25. candle.

(Additional items may be added if room permits)

Obviously, this list is not all-inclusive. Your instructors will assist in evaluating items for the local flying area. The unit life support officer must approve all kits and items carried on board the aircraft. The kits cannot conflict with other life support equipment or compromise safe egress. Except for matches, most items should not duplicate articles already provided.

Summary

Developing an attitude of “it won’t happen to me” is one of the most dangerous things you can do. You may suddenly find yourself in a survival situation unprepared. The parachute, PSK, and any personal survival kit you may carry offer many tools to help you in a survival situation. You must know where they are and how to use them!

Review Exercise JL0105

Complete the following review exercise by choosing the correct answer(s) or filling in the blanks.

1. Match the survival equipment item to its location (1-5).

   a. _____ Hook blade knife and pocket assembly

   b. _____ 4'x4' plastic sheet or transpiration bag, rough translucent

   c. _____ Survival kit, parachute pack, SRU-16/P

   d. _____ General purpose knife

   e. _____ Flexible packaged drinking water, 12 oz.

   f. _____ AFP 64-15

   g. _____ Mirror, emergency, signaling

   h. _____ Survival radio, AN/PRC-90

   i. _____ First aid kit

   j. _____ Whistle (plastic)

   k. _____ Tubing, latex, 6 feet.

   l. _____ Signal flare, MK-13 or MK-124

   m. _____ AN/URT-33C/M beacon set, radio

   n. _____ Signal kit, personnel distress

   o. _____ Blanket, combat casualty

   1. Pocket of parachute pack (upper right corner)
   2. Right front parachute riser
   3. PSK or survival vest
   4. Flare and mirror pocket of the parachute pack (right side, near hip)
   5. Next to the personal locator beacon

2. Select the incorrect statement concerning a personal survival kit.

   a. The life support officer must approve all kits and items.

   b. Kits must not conflict with other life support equipment or compromise safe egress.

   c. Matches are provided in issued equipment and are not necessary in a personal kit.

Lesson JL0106 — 4.0 Hours

Descent and Landing Techniques

Goals

1. Using the suspended ring and harness trainer, demonstrate and practice the following parachute harness suspension manipulations:

    a. Proper body position for parachute opening shock

    b. Methods of parachute control

    c. Proper body position for descent and landing over land and over water

2. Using two-foot and four-foot elevated platforms, execute proper parachute landing falls (PLFs).

3. Using a parachute harness, demonstrate proper recovery and release from the parachute during a simulated drag situation.

4. Using the Swing Landing Trainer (SLT), execute proper PLFs.

Assignment

Read JL0106 in the SG.

Introduction

During this period of instruction you will demonstrate proficiency in parachute harness and canopy manipulations, PLFs from elevated platforms, recovery and release from the parachute during a drag situation, and PLFs from the SLT. You will be expected to perform all of the demonstrations to the satisfaction of your instructor(s). This training is designed to prepare you for parachute familiarization training and a possible bailout situation from your aircraft.

We recommend bringing an extra flight suit to change into after training is complete. Bring your gloves for the training. Do not wear boots with zippers and ensure the boots provide support to the ankles. Remove jewelry and any objects from the uniform that could cause injury. Do not participate in the training if you are ill or have any joint or muscle injury (ankle, knee, back, shoulder, etc.). If you are in doubt, inform the instructor. You will participate in approximately 10 minutes of warm-up exercises prior to beginning training. The exercises will be those considered best for the prevention of joint and muscle injuries.

Information

Your class will be divided into three groups with a minimum of two instructors per group. After the initial instructor demonstrations, each group will report to separate training areas with their instructors. Everyone completes the training by performing PLFs from the SLT. Your responsibility is to complete the training in a safe effective manner.

Suspended Ring and Harness Trainer

Goal 1 — Using the suspended ring and harness trainer, demonstrate and practice the following parachute harness suspension manipulations:

a. Proper body position for parachute opening shock

b. Methods of parachute control

c. Proper body position for descent and landing over land and over water

This device is designed to demonstrate/perform proper body position for opening shock (military free fall position), canopy manipulation, and descent and landing techniques. Your instructors will assist you in hooking up to the trainer and proceed through the demonstrations procedure by procedure. You will be expected to perform these techniques and procedures to the satisfaction of your instructor(s).

PLFs, Practice Area

Goal 2 — Using two-foot and four-foot elevated platforms, execute proper parachute landing falls (PLFs).

Practice of the PLFs will start at ground level. You will begin by maintaining the feet and knees together and making contact with the ground on all *five* points of contact. You will practice left, right, front and rear PLFs. When proficiency is demonstrated at ground level, you will continue to the two- and four-foot elevated platforms and perform the PLFs to the satisfaction of your instructor(s).

Parachute Drag Recovery

Goal 3 — Using a parachute harness, demonstrate proper recovery and release from the parachute during a simulated drag situation.

Parachute drag recovery is performed in the event you are unable to release from the parachute immediately after completing the PLF. You must release and recover as soon as possible to eliminate any further injury. However, do not release from the *training device* until the instructor has checked your procedures and body position and given the command "RELEASE."

PLFs from the SLT

Goal 4 — Using the Swing Landing Trainer (SLT), execute proper PLFs.

The SLT will simulate motion under parachute canopy. You will be expected to perform left, right, front, and rear PLFs to the satisfaction of your instructor(s). Always remember to keep the feet and knees together and your eyes on the horizon. You must be able to perform PLFs from the SLT in order to continue on to parachute familiarization training (parasail).

Lesson JL0107 — 4.0 Hours

Parachute Familiarization Training (PFT)

Goal

Using a parasail develop confidence in the ability to survive a parachute descent, control the parachute during descent, and correctly execute a parachute landing fall (PLF).

Assignment

Read JL0107 in the SG.

Introduction

After completing lessons JL0102 and JL0106, you will be briefed on procedures to follow during PFT. PFT provides you the opportunity to demonstrate your proficiency at canopy control and your ability to perform a PLF. Again; you may want to bring an extra flight suit to change in to after training is complete. Bring your gloves for the training. Do not wear boots with zippers and ensure the boots provide support to the ankles. Remove jewelry and any objects from the uniform that could cause injury. Do not participate in the training if you are ill or have any joint or muscle injury (ankle, knee, back, shoulder, etc.). If you are in doubt, inform the instructor. You will participate in approximately 10 minutes of warm-up exercises and you will also perform refresher PLF training prior to PFT (parasail).

Information

Training Method

Parasail training is a confidence-building program designed to prevent injury during actual aircraft bailout and to practice the proper and safe use of a parachute. It is accomplished after the procedures have been demonstrated/performed during Descent and Landing Techniques. The parasail canopy is an ascending/gliding parachute that facilitates forward travel by a series of ports or slots that exhaust air and establish a lifting angle of attack. By using the parasail, it is possible to tow you to altitude over land or water and to release you for unrestrained parachute descent. With the parasail, you can perform turns, execute PLFs, and perform equipment releases and anti-drag procedures, if required. Procedures will only be performed under the direct supervision and instruction of aerospace physiology parasail crewmembers. Pay close and careful attention to your instructors.

Operational Procedures

Prior to each parasail launch, you will be fitted with a parachute harness (with the parasail canopy attached) and a protective helmet. One-way communication, from the instructors to the students, is maintained by radio or by megaphone. Listen to the instructors. On your first ascent (Figure 7-1) and slow descent, you will remain attached to the tow vehicle. This tow up and tow down should alleviate any apprehension you may have had and prepare you for subsequent tows.

On the subsequent tows, you will be released from the tow vehicle for a free parachute descent to practice parachute steering and to execute a PLF. The descent and turns are very similar to a parachute descent with the four-line jettison modification.

Note — Do not perform any turns when you are attached to the tow vehicle. When you perform turns during the free descents, perform the turns by pulling down on the appropriate rear riser. The parasail does not incorporate the red lanyards found in the parachute.

Figure 7-1 — Tow-Up

Attachment 1

Answers to Review Exercises

Review Exercise 01

1. a. A
   b. B
   c. A
   d. B
   e. B
   f. A
2. a. 2
   b. 3
   c. 4
   d. 5
   e. 1
3. a. True
   b. False
   c. False
   d. True
   e. True
   f. False
   g. True
   h. False
4. a 9
   b. 7
   c. 6
   d. 5
   e. 2
   f. 8
   g. 3
   h. 4
   i. 1
5. a. P
   b. E
   c. C
   d. I
   e. R
   f. C
   g. C
   h. R
6. <u>DOs</u>
   a. Have the life support section inspect the mask at least every 30 days.
   b. Inspect and test the mask for operation before leaving the life support section (MQ-1 Tester)
   c. Clean and test the mask at the end of each flying day. Use cleaning solution and gauze pad to wipe interior of the mask faceform to remove perspiration, facial oils, and foreign matter.
   d. Check the helmet prior to each flight for overall condition. Check security of chin and nape straps, visor lens for cracks and scratches, cleanliness and operation of lens, attachment of communication connectors, and operation of communication connectors.
   e. Check the mask and helmet daily for wear and tear. Have items replaced as necessary.
   f. Check the bayonet connectors and ensure that the locking pins operate freely.
   g. Whenever possible, transport the helmet assembly in a helmet bag. When unable to carry the assembly in a helmet bag, carry the helmet and mask by the chin strap like a bucket.
   h. Have the life support section inspect your helmet any time it is dropped or cracked.

   <u>DON'Ts</u>
   a. Don't paint the helmet. Mark only as directed by applicable technical orders.
   b. Don't carry the helmet by the intercom cord, mask or visor housing.
   c. Don't allow the helmet to strike objects that would damage the protective surface.
   d. Don't disassemble the mask. This requires special tools and should be done only by qualified life support personnel.
   e. Don't modify or alter the mask.
   f. Don't store the helmet/mask in direct sunlight or hot environments for lengthy periods of time, or in the aircraft when at out bases.
   g. Don't allow sharp objects to come in contact with the mask because any puncture could damage the mask.
   h. Don't use pencils, pens, or sharp objects to loosen troublesome or sticking valves.
   i. Don't loan equipment. It was fitted and intended for personal use only.
7. b, e, g, i

Review Exercise 02

1. a. 2
   b. 3
   c. 4
   d. 5
   e. 1
2. c, a, f, d, b, e
3. c, a, f, d, g, b, e
4. a, c, f, d, b, e
5. d
6. a. Keep your eyes on the horizon. Do not look straight down at the ground, as it will interfere with your ability to judge distance.
   b. Place your fee together. Bend your knees slightly and point your toes toward the ground. Do not force the position of your legs or feet as tenseness can lead to injury
   c. Relax — repeat — relax

d. Take the initial shock of landing on the balls of the feet with your knees slightly bent.
e. The next point of impact should be on the side of one leg. A slight body twist in either direction at the instant your feet touch the ground will help.
f. The next points of contact should be the thigh, hip and back of the shoulder in that order
g. Activate canopy releases.

Review Exercise 03

1. b
2. a. straight, level
   b. 100
   c. 120
3. decision, eject
4. recovery, EJECT IMMEDIATELY
5. d, c, a, e, f, b
6. a. EMERGENCY
   b. ejection
   c. equipment
   d. zero-delay lanyard
   e. aircraft
   f. emergency oxygen cylinder
   g. attitude
   h. oxygen, cord

Review Exercise 05

1. a 2
   b. 3
   c. 5
   d. 4
   e. 3
   f. 5
   g. 4
   h. 3
   i. 3
   j. 3
   k. 3
   l. 3
   m. 1
   n. 4
   o. 3
2. c